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U. S. PATENT OFFICE

Who Pays the High Cost of Freight Handling?

IN the marketing of almost any kind of commodity, one of the chief items of expense, if not the most important, is the matter of transportation and continual handling. The various commodities are produced in different districts restricted in their productivity by natural climatic or geographic conditions, but the use of these products in either their natural or manufactured forms is general throughout the civilized world.

It is in the moving of these raw products from the localities of production to the localities of manufacturing activity, and then again distributing the finished product to the consumer, that we are brought into contact with the activity of transportation in its many intricacies and variations. The products are carried here and there over the earth's surface, loaded into wagons, boats and cars; unloaded, trucked and carried into and out of stores, warehouses and factories, and otherwise handled many times in their passage between the producer and the consumer, through the hands of wholesalers, jobbers and retailers. While the cost of this handling must eventually be paid by the consumer, it is an expense that more immediately affects the producer and jobber, as on it largely depends their ability to meet the competition in their various markets. Any method, therefore, that will effectually reduce this expense by the saving of time or labor, will benefit everybody, enabling the producer and the jobber to meet competition in the most distant markets, and lowering the cost to the consumer.

Antiquated Terminals Must Go

A TRIP about the waterfront of New York City and the Jersey side of New York harbor discloses more typical wharves and sheds of an inefficient character than one would suppose it possible to collect, each bearing the earmarks of some original idea, but nearly all without any evidences that efficiency in cost, time or labor for the handling of cargoes had ever entered the head of anyone connected with the terminals.

Probably the building of most of them was deferred until it became necessary to rush the work through in the shortest possible time, when it was turned over to an engineer who knew more of waterfront foundations than of freight handling, with neither the inclination nor the time to investigate that phase of the problem, and with orders to rush it out in the usual rapid American fashion, and it was done.

It would seem that the time has come in which we must break away from typical methods and adopt new types if we are to keep up with the general trend, and particularly is this true of means and methods utilized in the conveying of cargoes between the holds of vessels and land carriers, for the limiting feature in the loading or discharging of a vessel lies not so much in the method used for moving the cargo between the wharf and the vessel's hold, although that is susceptible of improvement, as in the movement between wharf edge and trucks, or other carriers, through the storage reservoir.

The World's Greatest Port

NEW YORK is the most important port in the world. Forty-seven percent of the country's foreign trade is handled through this port, and the coastwise and river trade is much larger than the foreign trade.

New York has one of the best natural harbors in the world, but because of lack of co-ordination of terminal facilities an enormous amount of unnecessary work is done in handling these immense quantities of freight. Although New York has more waterfront than Hamburg, London and Liverpool combined, nevertheless Hamburg handles almost equal tonnage with only 24 miles of waterfront. London handles almost equal tonnage with 28 miles of waterfront, though handicapped by an 18-foot tidal range, and Liverpool handles almost equal tonnage in a small area, although handicapped by a 28-foot tidal range.

These three foreign ports are better equipped with terminal facilities, especially for warehousing, than is New York. In New York over 2,000 lighters, car floats, floating grain elevators, oil barges, coal barges, etc., are needed to handle railroad traffic alone. On account of these conditions, the movement of freight through New York is constantly handicapped by congestion on the piers and bulkheads, as well as on the adjacent streets and rail connections. Is it any wonder, then, that the cost of handling freight in New York, which is typical of American ports, forms such a big item in the total cost of transportation?

The improvements by which such conditions can be bettered and the handling of freight at marine terminals made more economical are legion. Many of them are explained in the following pages, and to those of our readers who are anxious to save a dollar here and there or add to their profits in the field of transportation we heartily commend them for careful study.

What Are the Facts?

RECENT reports in the daily press give the impression that the battleship *Arizona*, built in a Government navy yard, has been completed in record time and at a saving of millions of dollars to the Government.

On what basis these claims are made we are at a loss to understand. Although the statement has been made that the vessel was prevented from going into commission for a month on account of the lack of a crew, nevertheless investigation has shown that as late as September 15 the ship was far from completion and that at that time the main turbines had not been run under load.

As to the cost of construction of the vessel, it is understood that in the peculiar method of bookkeeping employed in the navy yards an overhead expense of only 32 percent is carried, whereas, if the recommendations of the board of the Secretary of the Navy were carried out, the overhead expense would be about 75 percent of the direct labor. It is also understood that other items, such as leave with pay, which properly should be charged against the ships, are not included.

The truth regarding this matter from the navy department would be gladly welcomed.

The Barge Canal?

In the forthcoming State election in New York it is to be hoped that officers will be elected who will bring about some change in the situation regarding the new State barge canal. We have on file a letter from the Deputy State Engineer referring to the fact that sharp curves in the canal will prohibit the navigation of boats larger than about 1,700 tons, regardless of the fact that the canal locks are designed to accommodate boats of 3,000 tons. This letter reads in part as follows:

"You are quite correct in stating that the canal will not be able to accommodate boats of 3,000 tons in the excavated sections, although the locks will accommodate boats of this kind. I am of the opinion that the largest boat which will be practical for use on the canal as now laid out will be about 1,700 tons, although I would call your attention to the fact that when the interests of commercialism call for the further development of the canal the locks will be able to accommodate boats of 3,000 tons capacity."

With the slowness with which the work is proceeding it looks as though it will be many years yet before the canal will be of commercial use, and, by the time it is ready for use, "commercialism will call for the further development of the canal" so that boats a good deal larger than "about 1,700 tons" can be used.

In another letter the Deputy State Engineer wrote under date of April 18, 1914: "It is expected that the entire system will be in use during the season of 1916."

The people of New York have appropriated approximately $125,000,000 (£25,600,000) to build a canal which it was "expected" would be in use during the season of 1916. As yet the canal is very far from finished, and it is so improperly designed that it does not seem possible that it can be of the desired commercial use, especially with the tendency nowadays of using boats of the largest capacity possible.

In spite of the "expectation" that the canal would be ready for use during the season of 1916, practically nothing has been done in the construction of proper terminals. Regardless of party affiliations, the legislative authorities in the State of New York should take hold of this barge question with a good, firm grip and give the people of the State a real canal with proper terminal facilities, and give it to them promptly.

Draft of Ships in the Panama Canal

In order to calculate the draft of a ship in the fresh water section of the Panama Canal, through Gatun Lake, Gaillard Cut, and Miraflores Lake, from her draft in sea water, the Marine Division forces have adopted as a working formula:

Add one-fourth of an inch to each foot of draft in sea water.

Accurate computation in this matter would require consideration of the displacement curve of the ship and the density of the water, as determined by hydrometer tests; but for practical purposes the simple formula is very satisfactory.

Where the water plane area is approximately constant throughout the draft, the draft of a ship in fresh water is about 3 percent greater than in salt water. This is based on the ratio of the volume of water weighing one ton. A ton of clean, fresh water contains approximately 36 cubic feet; a ton of clear sea water in the open ocean, approximately 35 cubic feet. The depth to which a vessel will sink, displacing water, till it reaches equilibrium will vary as the quantity of water required to make a ton. Accordingly, as 36 is greater by 2.857 percent than 35, the draft of a rectangular parallelepiped in fresh water is exactly 2.857 percent greater than in salt water. One-fourth of an inch is slightly over two percent of a foot; but on account of the sediment in the water in the Cut, due to the dredging operations, and also on account of the fact that the water plane areas are smaller near the keel than near the surface, the local formula gives more nearly accurate results with respect to passage through the Cut than the usual forms of rough calculation.

Harbor and Waterway Improvement Work in Russia*

At Vladisvostók during the past year extensive port improvements have been carried out to accommodate the largely increased volume of ocean traffic brought about by the war. The improvement work has been in general of two kinds; one, the dredging out of new mooring places for ships; and the other, the providing of new unloading facilities by means of floating and pier cranes. In addition, along this portion of the city waterfront, the open freight storage places have been enlarged, new roofed warehouses have been built, and spur tracks from the main railroad line have been extended to many places.

Across the peninsula to the west, in the Gulf of Amóur, new accommodations have been provided for coastwise traders; steamers at this port can now be unloaded into lighters.

Nikoláievsk, on the Amóur, which has also seen a considerable increase of shipping due to the war, has been improved in a variety of ways. As at Vladivostók, many new mooring places for ships have been dredged within the harbor. New dredges for this work have been ordered abroad and other dredges which had already been ordered for other work have been transferred to this as fast as they were completed. On the shore new embankments and warehouses have been built, and the general facilities for handling ocean freight have been vastly enlarged.

The Vólga-Donskóy Canal, by which the Don and Volga Rivers would be connected, has been seriously taken up at recent meetings of the Coal Section of the Special Conference upon Fuel. A report submitted by Professor Pouzirévsky gives the estimated cost of the construction of the canal as $25,000,000 (£5,125,000), and his presentation of the matter was considered a very favorable one by the Section. By various improvements on the plans referred to, it was asserted by other speakers that the canal could be completed within a period of two years. The transportation capacity of the canal was reckoned at a maximum of over 800,000 long tons, which by this means could be transferred from the Don Basin into Central Russia, where that fuel was very greatly needed. The success of the transport was declared to be dependent not only upon the building of the canal, but upon the

* From *Russia*, published by R. Martens & Co., Inc.

operating through it of a sufficient number of properly constructed cargo boats.

Moscow is expected to have a large new river port completed during the present calendar year as the outcome of agitation of the matter for some years, and a serious overtaxing during the past year of the city's river traffic facilities. The question originated several years ago as part of a project for improving the water route from Moscow to Nizhni-Novogrod. This route takes goods from Moscow on the Moskva River, which flows southeastward until it joins the larger Oká River, which in its turn is merged in the Volga, where it helps to form the promontory on which are the grounds and buildings of the Great Fair. For about ten years past there has been an annual increase of about 27 percent in the freight traffic through Moscow and over the Moskva River. The freight business of the Moscow portion of the river bank has just about trebled in a period of eleven years. The situation has become much more urgent through the congestion of freight brought in by the railroads. The rapid construction of a new river port seemed urgent months ago, and the Ministry of Transportation has begun upon the task. One advantage that the Ministry possesses in this undertaking is the command of the labor of a large number of prisoners of war; by using them it seems possible to put through the necessary work during this year's building season.

Inefficiency in Handling Imports

BY H. A. SPAULDING *

One of the great problems of transportation companies is handling freight at terminals economically. Comparisons have frequently been made of the extremely high cost of handling freight at terminals with the cost of actual transportation, either by rail or water, and practically all of the railroad, steamship and terminal warehouse companies are giving attention to the modern labor-saving devices with a view of reducing the cost of handling freight in their terminals.

Knowing that all of the transportation and terminal warehouse companies are striving to operate at a minimum cost, the writer has been forcibly impressed by the inefficiency in handling imports subject to duty. This is a condition beyond the control of the transportation and warehouse companies and has a great bearing on the high cost of operation in terminals.

For example, in handling raw sugar from steamships: first, it is hoisted from the hold of the ship in slings, lowered on small platform hand trucks and moved a short distance from the side of the ship and piled on the dock by men employed by the steamship company; second, handled by the government men on to scales and weighed; third, handled from the government's scales directly to the merchant's scales and weighed the second time; fourth, taken from the merchant's scales, loaded on trucks and trucked to storehouse or car. The government's scales alongside of the merchant's scales can be seen in Fig. 1, as well as the number of men required for the double handling. This not only means a double cost for weighing, but also delays the general operation.

With a little co-operation on the part of the transportation companies, merchant and government, a system could be worked out so as to eliminate the second scale and a number of laborers, which would greatly reduce the cost of operation, increase the speed of handling, and facilitate matters for increasing business.

The most economical method would be to provide platform scales in place of the present type that would weigh a loaded truck. By this means sugar could be hoisted from the hold of the steamer in slings, deposited directly on electric or trailer trucks, which could be towed by an electric tractor. The loaded truck could then pass over a scale and be weighed and continued to the storage house or car. This system would eliminate a number of handlings and greatly reduce the total cost, which the public eventually pays.

Several companies handling goods similar to the above have installed a number of electric trucks and tractors,

Fig. 1.—Weighing Sugar at American Dock

and in spite of present conditions reduced their costs to such an extent that the electrics have proved to be a well-paying investment. With a revised system, electrics could be worked more efficiently, as there would not be the delays in handling as at present, and more electrics would be placed in service, which would effect a far greater saving.

In brief, this would mean a saving of labor to the United States government, to the steamship companies and merchants, and a splendid investment for the terminal warehouse companies, which from their point of view, particularly under congested conditions, would open a way for an increase of business not to be overlooked, and at the same time reduce the cost of product to the consumer.

Marine Terminal Improvements at Port of Philadelphia

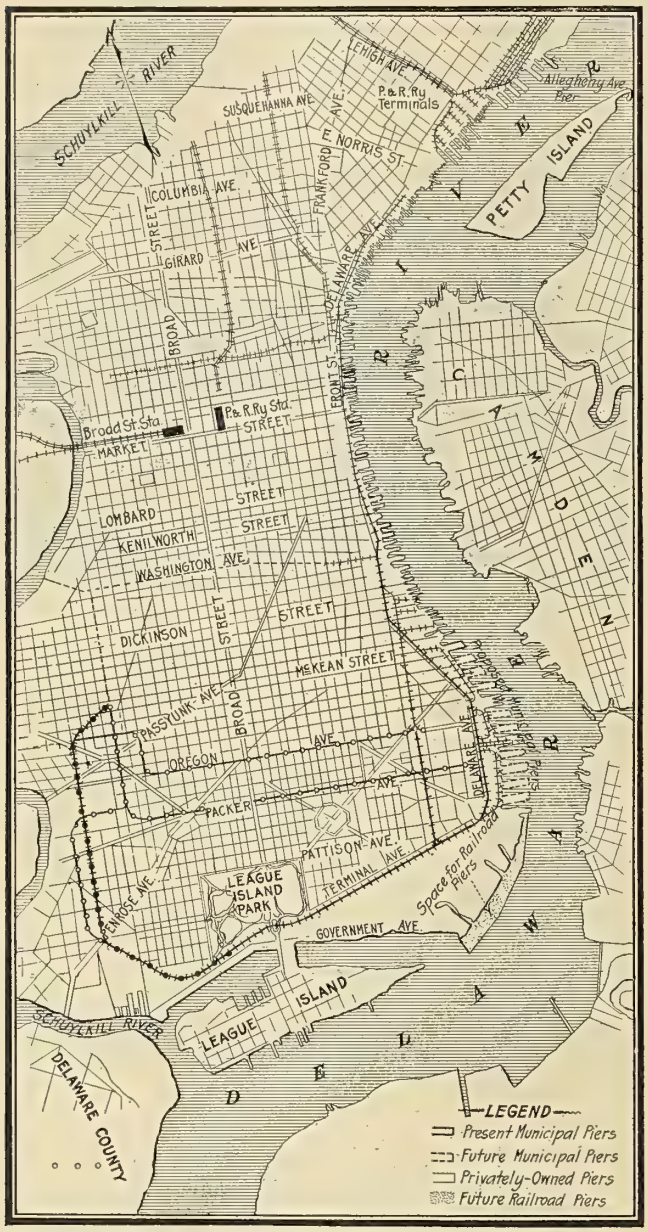
Progress is being made by the city of Philadelphia in its immense scheme to establish in the lower section of the city a great railroad freight terminal adjacent to a wonderful system of piers, now being constructed under the supervision of the Department of Wharves, Docks and Ferries.

During the last week in August certain tracts of land aggregating 340.77 acres have been transferred by individual owners to the Greenwich Terminal Company. Eventually, this land will be used as the site for freight terminal yards by the Pennsylvania Railroad Company and the Baltimore & Ohio Railroad Company. For years this land has laid dormant. Portions of it were farmed; other portions have been undeveloped because it is marsh. The total 340.77 acres has been assessed by the city at a value of $106,500 (£21,800).

The transfer of property mentioned involved values

* With the General Vehicle Company, Inc., Long Island City, New York.

given at approximately $4,500,000 (£924,000). The aggregate cash payments to the various owners was $1,440,482 (£295,500), and the aggregate ground rent encumbrance was $109,526 (£22,400), the principal of which, on a 4 percent basis, amounts to $2,738,100 (£561,000). This immense increase in valuation has been brought about by the announcement of the city's plans to improve the port facilities, to construct piers and great wharves, and to



Philadelphia Water Front, Showing Proposed Terminal Development

make at the lower end of the city a freight terminal that will be unequaled in capacity and equipment by any other terminal in the world.

The whole plan of development is progressing steadily. Eventually the railroad companies will acquire the same land which was transferred to the Greenwich Company, and it is expected that at least a million and a half dollars will be expended by these corporations in the construction of the several freight yards. The city's engineers have progressed rapidly with their plans for the improvement of the port.

A tentative estimate of the cost of the proposed improvements has been arrived at; and in his report to Mayor Smith, George S. Webster, the Director of the Department, calls attention to the importance of constructing new piers as rapidly as possible. He points to the fact that during the first seven months of 1916 the import and export trade amounted to $216,295,478 (£44,500,000), or $14,000,000 (£2,870,000) more than the total for 1915. The coastwise traffic was as great. These figures demonstrate the increasing business of the port.

Mr. Webster says further in his report to the Mayor: "In 1915 the gross tonnage of the arrivals of vessels from foreign and coastwise ports amounted to 9,315,157, and the clearances for the same period figured up to 9,377,901 tons. There can be no dispute as to Philadelphia's ranking as the second port in the United States. No person familiar with shipping conditions would, for an instant, entertain the thought that either Boston or New Orleans is of the importance of Philadelphia.

"The activities of the port were never greater than at present. There is a constant demand for space on the municipal piers. It is this condition which has increased our desire to push matters rapidly, and the engineers of this Department have been working upon the estimates of cost for these improvements."

The tentative figures of costs given by the Department engineers are as follows:

(a) To complete the McKean Street Pier (construction now under contract), which will be 250 feet wide by 900 feet long, of the two-story type, with pile foundation and with structural steel and reinforced concrete superstructure. Estimated cost	$300,000
(b) For the purchase of a site and the construction of a one-story pier, approximately 80 feet wide by 535 feet long in the vicinity of Cherry street, this being opposite the center of the city, to be used for the accommodation of river traffic. Estimated cost	750,000
(c) For the purchase of property and the construction of a double-deck pier, 80 feet wide by 550 feet long, similar to the present new piers in the Southwark Group, to be used for general commercial purposes, and to be located near the foot of Kenilworth street. Estimated cost	1,000,000
(d) For the purchase of property and extension of Allegheny Avenue Pier in the northern part of the city, for use as a general freight land for river steamers, and for recreation purposes. Estimated cost	500,000
(e) For the purchase of property and extension of the pier at Penn Treaty Park, also the pier at Bridge street, Bridesburg, for general freight landing for river steamers, and for recreation purposes. Estimated cost	100,000
(f) For the completion of the bulkheading of the Schuylkill River. Estimated cost	750,000
(g) For the acquisition of property and the erection of modern piers on the Delaware River front, south from the new McKean Street Pier, in what is known as the Moyamensing Group, and possibly for the erection of new piers in the northern central portions of the waterfront. Estimated cost	6,600,000
	$10,000,000 (£2,050,000)

Director Webster's communication says: "The agreement entered into in March, 1914, between the city and the railroad companies, provides for the sale to the city, for the purpose of erecting municipal piers, of about 2,500 feet of waterfront on the Delaware River by the Pennsylvania Railroad, a portion of which is now occupied by their Greenwich coal piers, and of about 925 feet of waterfront at Snyder Avenue by the Baltimore & Ohio Railroad Company. The loan provides $3,300,000 (£676,000) for this purpose.

"A feature of the South Philadelphia improvements is the extension of Delaware Avenue, the marginal commercial street along the river front which is now being extended to the southward to the width of 200 to 250 feet, which is believed to be ample for the accommodation of both railroad and vehicular traffic.

"The general plan includes the adoption of a street system, which provides a main avenue for traffic, attractive layouts for parks and playgrounds, a civic center of ample size and many attractive features which will encourage the general development of that section and make it more sanitary and wholesome."

What is to be Expected of the Shipping Bill?

Is it a Paternalistic Blunder or One of the Best Pieces of Constructive Legislation Ever Passed?

BY "OLD SCOTCH"

WHEN President Wilson affixed his signature to the Shipping Bill on September 7 last, that much discussed, much maligned and much misunderstood measure became a law after one of the stormiest voyages through legislative seas ever encountered. As it has finally been placed on the statute books, it is either a paternalistic blunder or one of the best pieces of constructive legislation ever passed in the interest of American shipping, according to your point of view. The latter is the writer's viewpoint, and it is proposed herein, as briefly as possible, to state how he arrives at that appraisal.

Formation of Shipping Board

First and foremost in importance is the formation of the Shipping Board itself. Now we are to have a finite head to the great shipping interests of the nation. Under the law it must be composed of men selected "with due regard to their fitness for the efficient discharge of the duties imposed on them," hence they will be men who know the shipping business. The great shipping industry has heretofore drifted along without any centralized authority. When Congress has desired data and advice concerning pending legislation, it has had no responsible source from which to obtain the facts. Many of the efforts towards constructive legislation regarding shipping have been handicapped largely because of that fact. Every other important maritime nation has an organization such as the British Board of Trade, which can and does pass upon important matters regarding its shipping.

One of the most important sections of the act is one about which but little has been written or discussed. I have reference to Section 12. In general, its requirements are that the board shall investigate the relative cost of building ships here and abroad, and the disadvantages of operating registered American vessels in the foreign trade. It shall examine the rules under which vessels are constructed abroad and the whole subject of marine insurance with a view of developing an ample American marine insurance system as an aid to the development of the American merchant marine. It is also directed to examine into all the navigation laws for the purpose of reporting to Congress what amendments, improvements and revision of such laws are necessary for the development of our shipping.

Clause Instigated by Marine Engineering

The Shipping Board is further directed to investigate the legal status of mortgage loans on vessel property, with a view to means of improving the security of such loans and encouraging investments in American shipping. In passing it might be well to note that this important clause was included in this section of the bill at the instigation of Marine Engineering.

One does not have to be more than ordinarily familiar with present conditions to realize the great importance of these instructions to the board. If, as many people believe, certain sections of the so-called Seamen's act ought to be modified or repealed, the favorable recommendation of the Shipping Board will be the only practicable means to that end. Much has been said and written about the inadequacy and antiquity of the various navigation laws. Their repeal or modification can only be brought about after an intelligent investigation and recommendation by the board. In fact, under Section 12, anything that pertains to the upbuilding of our merchant marine can be intelligently investigated and reported upon through the medium of the board. Needless to say, such recommendations will have more weight with Congress than any that have heretofore been submitted to it.

In my humble opinion the building of the proposed fleet, and the possible operation of some of its units by the Government, are matters of secondary importance in this important law. No sane person has ever thought that providing about 500,000 tons of naval auxiliaries, such as is proposed in this act, would furnish us with a merchant marine. It will be merely a demonstration fleet to encourage other Americans to go into the business.

None can deny after the expert testimony before the congressional committees, that the Government needs these ships for purposes of national defense, as auxiliaries to both the army and the navy. No sensible person would seriously advocate that such a fleet, after it is constructed, should be tied up in navy yards and allowed to deteriorate. It is entirely a logical proposition that they should be leased to shipping men and used for the purpose of extending our trade.

Competition With Private Enterprise

It is also entirely reasonable that other new lines are needed and demanded by our exporters, that in the absence of any private enterprise to establish them the Government itself, in the interest of all, should start the lines, and when they have been developed into paying properties to dispose of them to the highest bidders.

All the hue and cry about paternalism and government operation in competition with private enterprise has been the result of building up straw men and knocking them down. Section 11 of the act clearly provides that no corporation of which the Government is a stockholder, under authority of this act, shall engage in the operation of any of these ships until a bona fide effort has been made to contract with private parties to purchase, lease or charter them. Furthermore, there can be no Government operation of any of the ships after the expiration of five years from the date of the close of the European war. There will undoubtedly be a sharp demand for everything that floats for at least five years after the war is over, as the present deficiency in the world's shipping cannot be made up in that time. The chances, therefore, of the Government ever operating any of these ships is very remote, to say the least.

One of the greatest bugaboos connected with the act is the fact that Section 9 provides that foreign-built vessels admitted to American registry or enrollment and licensed under the terms of the shipping law, may engage in the coastwise trade of the United States. There are two good reasons why this need not worry those who, like myself, believe in keeping the coastwise trade for American-built ships only. The first is that foreign-built ships, complying with the requirements of this law, cost just as much and probably more at present than American-built ships. This is best evidenced by the number of ships now being built in American yards on foreign orders. The other reason is that I cannot conceive of the mental

attitude of the members to be appointed on the Shipping Board, who would wilfully open this gateway to an influx of foreign-built ships into the American coastwise trade, when the very objects of this new law are the "encouraging, developing, and *creating* of a merchant marine to meet the requirements of the commerce of the United States, etc." If such an attempt should ever be made, it does not require much prophecy to foretell the finish of the board which attempted it.

Coastwise Shipping Not to be Molested

The underlying reason for the insertion of this clause in the bill, I understand, was, for example, in the case of a foreign-built vessel purchased by the board and engaged in the foreign trade of the United States, arriving at one American port, say at New York, discharging her cargo there, and being engaged to carry her outbound cargo from a distant port such as New Orleans, to be allowed to carry a cargo from New York to New Orleans. Such procedure would not appreciably hurt any American-built vessels engaged in the same transoceanic trade.

It must be kept in mind that under previous laws foreign-built vessels owned by Americans can be registered under the American flag. Until war conditions made it desirable very few, if any, foreign-built vessels were ever put under the American flag and engaged in our foreign trade.

Section 9, if not abused, may, therefore, be very beneficial in promoting our foreign trade when normal conditions return.

The purchase of vessels by the board is surrounded by a number of safeguards put on in the Senate to satisfy the apprehensiveness of many that the board would not use good judgment. They are, first, that no vessel engaged in the foreign or domestic commerce of the United States can be purchased unless the owners thereof had decided to withdraw it from such commerce; second, no vessel under the register or flag of a foreign country engaged in war can be bought; third, no vessel of any kind which is not adaptable for the purposes specified, or which cannot by reasonable alterations and repairs be made so, can be obtained by the board, and fourth, no vessel which has deteriorated to less than seventy-five percent of its original efficiency can be bought, regardless of whether it could be repaired and altered and brought up to that efficiency. While it is extremely doubtful if the Shipping Board would ever purchase any such vessel without such restrictions, the insertion of these amendments evidently satisfied some elements which were skeptical on those particular points.

Rate-Controlling Features

There seems to be but little doubt as to the advisability of the rate-controlling features of the law: a perusal of the many sections of the bill relating to this feature leads to the conclusion that the functions of the board are not to fix rates, but to stop the well-known abuses which have crept into the shipping business, such as "deferred rebates," the use of "fighting ships," etc.

The elimination of two cabinet officers as ex-officio members of the Shipping Board seems to meet with general approval. The same cannot be said in regard to the reduction of the salaries of the members of the board from $10,000 (£2,050) to $7,500 (£1,538) per annum. Capable men for such an important duty make much more money in private life than the latter salary, and it will result no doubt in handicapping the appointment of high-class men for these positions. So much depends upon the qualifications of the commissioners as to the ultimate success of this entire venture that it is regrettable, to say the least, that this cut in salary was made. Better by far had the salaries been fixed at twice the amount, as the importance of the shipping industry to this country fully warrants the best men obtainable.

The concluding clause of the law, designed to offset any attempt to blacklist American merchants by the refusal of foreign ships to receive their cargoes without good and sufficient reasons, is of far-reaching importance at the present time.

Taken all in all, it is believed that the operations of the new shipping law in its entirety will prove of the greatest benefit to American shipping, and that many of its opponents will be agreeably disappointed by its results.

Corporation Formed to Study Terminal Problems

Announcement was recently made in New York City of the organization in the State of Delaware by the National City Company, Stone & Webster, and the American International Corporation interests of a corporation to be known as the American International Terminals Company for the purpose of studying problems relating to railway, steamship, warehouse and industrial terminals. It is a well-known fact that the capacity of a railroad is limited by what its terminals can handle. Likewise, the greatest preventable waste of the available time of cargo ships occurs at docks and anchorages incident to loading and unloading. Transfer facilities in general are more difficult, more costly and less understood than the straight carriage of goods by rail or by boat. So many propositions for the improvement of terminals of all ports of the world have come up that it seemed advisable to form a corporation properly organized and equipped to study the one broad subject of terminal facilities.

The National City Bank has for the past two years been building up a special commercial service in the aid of foreign trade. Its numerous branches in the Latin-American countries and the branch it is now organizing in Italy put the City Bank into direct relation with shipping problems. Its interests in the new corporation will be represented by officers of the National City Bank.

That the American International Corporation should take an interest in the Terminal Company is to be expected, as shipping and shipping facilities have claimed its attention from the start. Its holdings in the International Mercantile Marine and the United Fruit Company, and its control of the Pacific Mail Steamship Company, explain its direct contact to a large number of ports throughout the world. In many of these ports there is great waste of effort caused by inadequate or badly arranged facilities.

Stone & Webster, the other stockholder, is perhaps the largest engineering and construction firm in the United States. They have a highly developed engineering organization and technical staff of known efficiency in these lines.

The new corporation has retained as consulting expert Mr. Will H. Lyford, who for more than thirty years has been connected with the largest terminal railway system in Chicago, and has co-operated in shipping terminals in several other cities. The directors of the corporation include George S. Baldwin, vice-president, American International Corporation; William S. Kies, vice-president, American International Corporation; Richard P. Tinsley, secretary-treasurer, American International Corporation; James H. Perkins, vice-president, National City Bank; Edward P. Courrier, National City Bank; Charles E. Mitchell, vice-president, National City Company, and Edward S. Webster, Henry R. Hayes and Oscar E. Stevens, all of Stone & Webster.

(Photograph by the Pictorial News Company)

Shipping Exports to Russia from Bush Terminal Piers, Brooklyn, N. Y.

Motor Trucks at Steamship Terminals

Average Saving of Over 36 Percent in Ton-Mile Cost of Hauling With Motor Vehicles—Other Benefits

BY H. C. HUTCHINS * AND H. W. PERRY †

IT is doubtful if more than one in fifty of the trucks and wagons used by shippers for hauling freight to and from the steamship piers in New York is motor driven. A similar condition prevails at steamship terminals in other seaboard and Great Lakes ports. The horse-drawn vehicle practically monopolizes this field everywhere, notwithstanding the rapid increase in the use of motor trucks throughout the country and the demonstrated superiority and economy of motor haulage. Many large manufacturing and mercantile houses would prefer to use motor trucks for hauling to and from the piers, and it would be to their advantage and to the advantage of the steamship companies if they could do so, but there are a number of conditions that make it impractical.

Most important of these is the long delays of vehicles at the docks waiting to load and unload goods. It is not at all uncommon for teamsters to wait one, two or three hours for a chance to get onto the piers. There is a tremendous congestion of vehicles in front of and on the piers in lower New York, and often a truck cannot haul more than two or three loads in a day, although the length of haul may be not more than a mile or two. Now, it is one of the axioms of the motor truck industry that these vehicles must be kept moving at least half of the working hours of the day; otherwise it is cheaper to use horses. Their function is transportation, and, like a steamship, they are losing money all the time they are standing still, and they lose it faster than a standing team, because there is a larger investment of money tied up in them, a higher rate of depreciation, and the individual machine costs more to operate and maintain than a team and wagon. On the other hand, when moving, the greater capacity and speed of the motor truck enables it to do the work of at least three teams, so that, under ordinary conditions, it is more economical than teams.

In the second place, when the trucks finally get on the piers, the actual loading or unloading takes an unnecessarily long time, which further impairs their usefulness by increasing their standing time.

Again, the admission of gasoline (petrol) trucks to some of the piers is still prohibited because, under the rule of the Board of Fire Underwriters, a higher rate of insurance is charged on the dock property if such vehicles are allowed upon it. A few years ago most of the steamship companies barred gasoline (petrol) trucks on this account, but now all but a few admit them, although the insurance companies still discriminate against them with

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a higher premium rate. The most important of the piers from which they are excluded are those of the International Mercantile Marine.

A great deal of the hauling to and from the piers is done by public draymen, who, for the reasons stated, and because most of the trucking is short-haul work to downtown warehouses and stores, have not adopted motor trucks. But there is another element of some importance in the situation, and that is the prejudice of teamsters and stevedores, who use various tactics to delay and hamper the movement and loading and unloading of motor trucks.

Undoubtedly the general use of motor trucks by shippers and draymen would benefit themselves and also the steamship companies. This is indicated plainly by their very extensive and successful use in many other kinds of work and by their rapid increase in number. So far as the shipper and draymen are concerned, they would profit by the lower cost of hauling by motor truck. Just how much less this cost would be cannot be stated for this particular line of work, but carefully compiled records of costs of the hauling and delivery services of fourteen prominent companies engaged in different lines of business in ten large cities show the average ton-mile cost of hauling with motor vehicles to be 11¼ cents, as compared with 17¾ cents by horse-drawn vehicles. This is an average saving of 36⅔ percent. These costs include all items involved in the services, such as drivers' wages, interest and depreciation, insurance, storage, repairs, fuel, oil and tires. The businesses represented are contracting, cut stone, expressing, coal, oil and dressed meats.

Gains for Steamship Owners

As for the steamship companies, it must be obvious that whatever will aid in clearing quickly the piers and docks of accumulations of freight and shorten the loading and discharge of cargoes so that ships can get under way again, will be to their advantage. Ships, like motor trucks, earn money only while they are in motion. Their sole function is carrying, and every day or hour they are tied up in port reduces their earning capacity.

Considering this evident fact and bearing in mind the highly efficient methods of loading and discharging grain, iron ore, coal and oil in use on the Great Lakes and at the Standard Oil Works, whereby huge steamers are loaded and unloaded in a very few hours, the methods of handling freight still in vogue at most piers are surprisingly antiquated and inefficient. There is almost a complete lack of modern mechanical means for loading and discharging cargo, for moving it on the docks and piers and for loading and unloading trucks and drays.

A number of causes account for this. Miscellaneous cargo cannot be handled by a single mechanical method, as grain can be discharged from elevators through chutes into the hold, or as coal can be dumped by the carload simply by tipping a railroad car over in a crane, or as oil can be run through pipes. Moreover, a considerable number of the piers in New York are owned by the city and rented to the steamship companies, so that installation of any improved mechanical devices must wait upon the city and the recommendations of the Department of Docks and Ferries.

Granting these conditions, the facts remain that the marine terminals in general are far from up to date in freight-handling methods, that shipping and vehicular congestion are almost intolerable, that port facilities might be increased several fold by intelligent study, that steamship companies and dock property might increase their earnings materially and that shippers and consignees could be saved a great deal of annoyance and loss if the piers were modernized and freight were handled systematically.

The steamship and railroad companies and other owners of dock property could very well take some lessons in efficiency methods from large modern industrial plants, warehouses and even department stores, contractors and small factories. These plants make use of every conceivable modern mechanical time-saving and economical device for handling goods and materials of all descriptions. Up-to-date factories are systematized to the *n*th degree, so that there is a steady progressive movement of materials and parts, from the raw materials entering at one end to the finished product emerging on the shipping platform or aboard ships, cars or trucks at the other. It is thus that production costs have been reduced. Some of the large new automobile factories are marvelous examples of this systematic arrangement and the quick and economical handling of materials and parts by mechanical means. What such systems and methods mean in efficiency will be understood from the fact that in one automobile factory 250 cars are assembled in nine and a half hours. The time for assembling each car, from start to finish, is three and a quarter hours.

Freight Handling in Warehouses

The great new warehouse of Austin, Nichols & Company, wholesale grocers in Brooklyn, affords a fine study in expeditious handling of miscellaneous goods. Railroad tracks pass through the full length of the building at one side, with loading platforms on either side. There are docks at one end on the East River, and at the other end is a covered loading platform for road vehicles. Down the center of the shipping floor are belt conveyors, and from top to bottom of the building there are three groups of spiral chutes communicating with all floors. Incoming goods are raised to the upper floors by large elevators, of which there are eight. The goods are handled by electric factory trucks or by hand trucks. Outgoing shipments are carried on these trucks to the spiral chutes on the different floors and descend by gravity to the ground floor nearest to the point whence they are to be loaded into ship, railroad car, or motor truck or wagon for local delivery. Some of the chutes discharge upon the conveyors and others upon the floor. Thus the trucking within the warehouse is minimized and the goods moved as rapidly as possible. The elevators are used very little for descending freight. Groceries are stored, of course, very systematically, so there are no delays in filling orders from stock.

Mechanical Appliances

In addition to these systems and appliances, many mechanical devices are in use among manufacturers, merchants, shippers and others, such as traveling cranes, escalators, overhead trolley or telfer systems, bucket conveyors, etc. Certainly some of them might be used advantageously on steamship piers, and it appears that the time is ripe for a wholesale revolution in freight handling at steamship and railroad terminals. There is no apparent obstacle to building six-, eight- or ten-story warehouses in combination with the docks, the first two or three levels to be used by the steamship companies and the upper floors as warerooms to be rented to manufacturers and merchants, as is done by the Bush Terminal Company in Brooklyn. Systems of chutes, ramps, conveyors and elevators could connect these floors with the shipping floors.

One of the two lower floors could be devoted to incoming cargo and another to outgoing. This would prevent confusion and also enable the operations of discharging

COSTLY CONGESTION AT NEW YORK MARINE TERMINALS

Photograph by Edwin Levick, N. Y.

Hand Trucking Coffee with Three Men to a Truck

Photograph by Pictorial News Company, N. Y.

Handling Raw Sugar at Bush Terminal Piers

Overflow of Freight from One of the North River Piers Piled Up on Farm

Interior of Jersey Central Pier, One-Story Construction, Lack of Loading and Unloading Facilities

Photograph by Edwin Levick, N. Y.

Interior of Hamburg-American Pier, Showing Railroad Down Center, but no Platform at Level of Car Floors

Photograph by Pictorial News Company, N. Y.

Interior of North River Pier, Showing Floor Congestion and Shed Space Not Utilized

and loading ships to be carried on simultaneously. As soon as one hold is emptied, reloading could begin while the next hold is being discharged. In this way the waiting time of the ship could be cut down nearly one-half. Conveyors, power trucks and other mechanical devices should be used in this work wherever possible instead of hand trucks.

Clearing freight from the receiving floors would be greatly expedited by having the freight platforms raised to the level of the wagon and truck beds, as at railroad

Slow and Costly Method of Discharging Cotton Cargo

freight houses, so that freight could be run directly on and off on small trucks or rollers. Under the prevailing arrangement everything has to be lifted up to and down from the body of the vehicle at a tremendous waste of time and effort. A ramp 16 or 18 feet wide and with a grade of, say, one in five, would permit vehicles to drive up to the second level, passing descending vehicles on the way. It might even be feasible to build a huge conveyor or moving sidewalk sunk to the level of the freight platform or floor of the pier, passing up one side and down the other. Goods from the ships could be discharged directly upon this and taken off as they pass any given numbered or lettered section on either side of the pier.

It seems hardly necessary to call attention to the desirability of segregating freight by name of consignee, so that the driver of a vehicle calling for it can locate his consignments immediately and get at them for removal without difficulty. Many of the companies make a practice of doing this, among them the New York Dock Company and the International Mercantile Marine. The former has the pier sections numbered and marks these numbers on its check sheets, so that when freight bills are matched with the check sheets the numbers are transferred to the freight bills to show consignees where to look for their goods. The same system is also used at other piers.

It is equally desirable that the handling of all records of freight in the offices be thoroughly systematized, so there will be no delays there in giving the location of consignee's freight to the driver, getting his receipt and letting him begin loading. In short, everything possible must be done to enable drivers to get into the piers, load or unload, and get away again without delay of any kind. When these long delays, so common at present and in the past, are eliminated, motor trucks will come into more general use at the terminals. This will help the steamship companies to clear their floors more quickly, because the trucks will make more trips per day than teams, they take up less room on the piers than teams and wagons, giving more room for freight; they are cleaner and more sanitary than horses, and can be backed into position to load or unload more quickly and with less noise and confusion than teams.

New York Terminals

There has been much talk in past years of the inadequate shipping facilities of the port of New York, and the congestion of freight during the two years of the European war has emphasized this condition. The city is undertaking the construction of large new piers at Forty-sixth street, work has been in progress for some time on the development of great docks in Jamaica Bay, and a new company has been formed for the building of a railroad and steamship terminal at Bayonne, along the lines of the Bush Terminal in Brooklyn. Yet the existing piers in the North and East rivers have not been utilized to anything like their maximum capacity. They might all be double or triple decked, equipped with mechanical loaders, and the handling of freight systematized. Much more extensive use could be made of electric stevedores in place of the prevailing hand truck.

The average cost of operating these electric warehouse trucks is less than $56 (11/13/4) a month, including wages of the operator, and they effect an average saving of $100 (20/16/8) a month apiece over the cost of doing the same amount of work with hand trucks. These averages were obtained from actual cost records of one year's operation of fifty-five electric trucks in a dozen different cities. Each truck has a capacity of two tons and a speed, loaded, of five miles an hour. H. B. Whipple, general manager of the New York Dock Company, states that under favorable conditions the electric tractor used for pulling large 4 by 14 foot dock trucks on the bulkheads and in the warehouse should save from 25 to 40 percent in the cost of shifting freight. The saving varies with the kind of freight, the amount handled and the distance it has to be moved. For trucking short distances, he says, a well-balanced system with hand trucks is hard to beat. However, where there are inclines to be mounted, each hand truck sometimes requires three men. The advantages of the electric truck are found, says Mr. Whipple, in the cases of long trucking, by reducing the number of men required and by doing the work more quickly than with horses or mules.

It has been estimated that more than 600,000,000 tons of miscellaneous freight are handled annually at marine terminals. The question of handling this enormous tonnage more expeditiously and economically involves not only the use of motor trucks, but also of system and all sorts of mechanical aids which will make the use of motor trucks by shippers and consignees of advantage to them. The use of motor trucks would reduce by at least one-half, and possibly by two-thirds, the number of vehicles em-

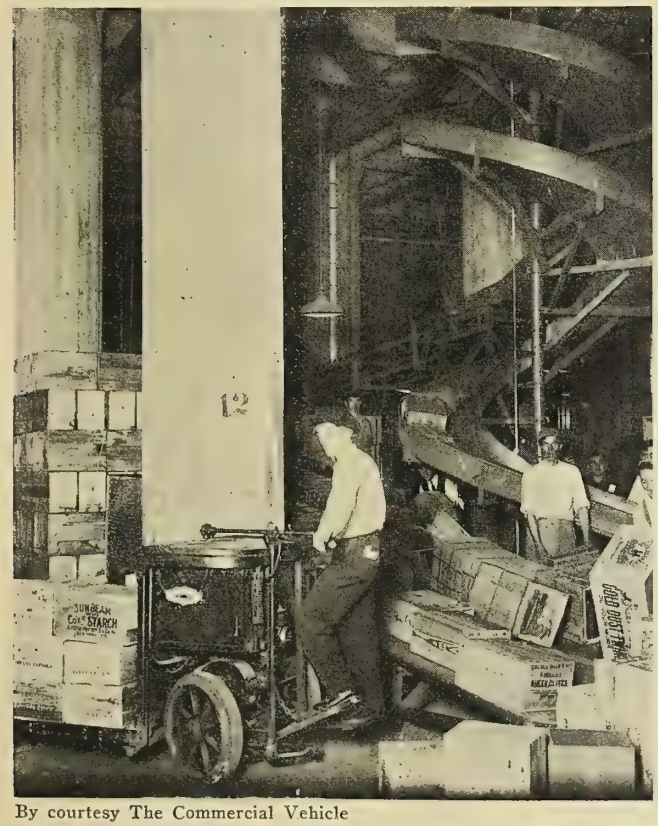
ployed in hauling from the piers. The cost of operating a five-ton motor truck averages about $15 (3/2/6) a day, everything included. One can be rented for $20 (4/3/4) a day, with driver. If the total standing time of the machine is five hours a day, due to waiting to get on the piers and to loading and unloading, there is a loss of $7.50 to $10 (1/11/3 to 2/1/8) through no fault of the owner or maker of the truck.

The motor truck has helped solve the serious problem of congestion of city streets and can do as much for the congestion at steamship terminals if given the opportunity. In the four years from 1911 to 1915 the tonnage carried by the streets of Manhattan increased 140 percent, while the number of vehicles increased only 72½ percent, due solely to the increased use of motor vehicles. The tonnage capacity per vehicle increased from 1.89 tons in 1911 to 2.63 tons in 1915, or three-quarters of a ton.

Use of Motor Trucks Rapidly Increasing

Traffic counts made by the Department of Public Works indicate that in a very few years the motor vehicle will constitute practically all of the vehicular traffic in New York streets. On Eighth avenue, at Forty-second street, the number of horse-drawn vehicles passing in ten hours, from 8 A. M. to 6 P. M., rose slightly from 4,528 in 1911 to 4,898 in 1915, while motor vehicles increased from 1,728 to 6,606. The number of motor trucks alone increased in that period from 537 to 3,309, or 516 percent.

Even with the present inefficient arrangement and equipment of the docks, the motor truck has numerous advantages so far as the steamship companies are concerned. In addition to those already mentioned, some of the trucks are provided with power winches operated by the engine or battery of the vehicle. This makes it possible to draw heavy crates, pieces of machinery, etc., on rollers and skids into the bed of the vehicle by power, greatly reducing the loading time. A great variety of methods of loading and unloading motor trucks have been developed and put into successful use.



By courtesy The Commercial Vehicle

System of Chutes, Conveyors and Electric Warehouse Trucks Used in Brooklyn Warehouse

Freight Escalator

The problem is not one of adapting the motor truck to freight terminals, but of adapting the terminals to the use of motor trucks so that advantage may be taken of their greater capacity, speed and economy. Seventy percent of all the traffic in the streets of New York is now by automobiles and motor trucks. The number of these vehicles has increased more than 108 percent in the last five years, while horse drawn vehicles have decreased 1.67 percent. Yet, for the reasons stated, motor trucks are hardly used at all around the docks and piers, and to only a slightly larger extent at railroad freight houses.

It is of interest in this connection to note the report made in 1914 by the Boston Chamber of Commerce after a careful study of traffic conditions in the Hub. Regarding steamship terminals, the report says:

Conditions in Boston Terminals

"The conditions at the steamship terminals affect street traffic of Boston in the same way as conditions at the railroad terminals, because if loading and handling of freight at these points is slow, teams and trucks are delayed, causing congestion at the terminals and frequently causing additional teams to be used, whose use would not be necessary if the teams first sent could get away from the terminals promptly.

"Failure to pile freight in an orderly and systematic manner causes much difficulty and seems to result from the lack of central authority for compelling it. . . . It would seem to be desirable to have certain well-defined rules regarding the assembling and piling of freight for different shippers and receivers, and to compel obedience to these rules. . . .

"A receiving platform, with checkers to give receipts, should be provided at the end of the wharf, nearest the street, or as near this point as possible, at which teams with small shipments could make deliveries and get their receipts without going the whole length of the wharf. It would seem to be simple common sense also that a method should be adopted for locating consignments of inbound freight so that loads for different consignees could be made up readily without unnecessary search.

Perspective Drawing of Proposed Water Gate for Honolulu

"If the cost of waiting time for teams and drivers occupied by searching for unlocated consignments were charged as a separate item on bills for teaming, there would be bitter complaint from the consignees at once.

"There seems no good reason why goods which are to be forwarded in bond should not be kept separate from free goods, and packages ordered to the appraisers' stores should be placed in one definite section of the dock, easily accessible to the bonded teamsters. . . .

"We recommend that goods remaining on the dock after a proper period be actually sent to a warehouse and the dock cleared.

"The inconvenient arrangement of the approaches and the inadequate size of some of the docks are matters of common knowledge. We would call attention to the satisfactory working of the two-floor dock of the Hamburg-American Line at Mystic wharf. Here import cargo is put on the lower floor and teaming is from the upper floor, from which the export cargo is loaded into the ship. Such an arrangement offers obvious opportunities for systematizing the handling of freight."

Final solution of this whole problem will not be found until the steamship and railroad companies are induced, or forced, by complaints against unnecessary shipping delays and excessive port charges, to undertake the collection and delivery of freight as a natural part of their functions as carriers, just as the express companies and the United States postal service do. When the transportation companies take over this work they will quickly realize the inefficiency and lack of economy that prevail at the terminals and will begin at once to rectify matters. They will find that the use of motor trucks under advantageous conditions is so superior to and so much cheaper than horse-drawn vehicles that the piers and freight houses will be modernized to facilitate instead of hindering their employment. And the collection and delivery of freight by large fleets of motor trucks operated by the carriers themselves will be so much quicker and cheaper than the present system of haulage by individual shippers, consignees and public truckmen, that everyone will wonder why it was not done long ago.

The present system can be compared with the situation that would exist if the express companies or the parcels post required the senders of parcels to bring them to the express houses or the general post office, and the receivers to locate and remove packages when called for at the receiving stations adjoining the railroads.

It would be cheaper for the shipper and consignee to have all hauling of freight done by the steamship and railroad companies, and the carrier companies could reduce the cost of this haulage so greatly by operating large fleets of trucks, installing time-saving mechanical devices and systematizing the classification of freight and the clerical work in their offices that they would make additional profit on the work.

Marine Terminal Proposed for Honolulu

William T. Donnelly, consulting engineer, of New York, recently submitted plans to the Harbor Commission of Honolulu for a water gate or marine terminal designed not only to provide a suitable entrance for all passengers arriving at the city by steamer, but also to provide a recreation center upon the water front for recreation purposes.

The plans contemplate a pier 200 feet in width by 600 feet in length, so located on the water front as to make it readily possible for all entering passenger steamers to touch at the outer end or head of the pier and land passengers and their baggage with the least delay and then to proceed to other piers for the unloading of cargo, touching again at the passenger pier upon their way out.

For recreation purposes the pier is so arranged that in the center is a swimming pool, 100 feet wide by 400 feet long, suitable for holding water carnival events. The architectural features of the design were worked up under Mr. Donnelly's direction by Mr. Bloodgood Tuttle, an architect of New York, who has adapted in the design features which are characteristic of the country and city which the pier is designed to serve. The landing from vessels at the head of the pier is under an arch 100 feet

in span at an elevation of approximately 30 feet above the water. At this level a gallery or deck 50 feet in width extends the entire length of the building on each side, with stairways to the lower street level and to an upper gallery. This arrangement makes possible a seating capacity in the structure of between 20,000 and 25,000 persons.

Recently the Harbor Board of Honolulu authorized the Superintendent of Public Works to proceed with work on sketches for a recreation pier on which will be an auditorium capable of seating several thousand persons. Favorable action is anticipated on the construction of such a pier, although the facilities for adapting the pier as a marine terminal as outlined by Mr. Donnelly in his proposed designs have not as yet been included in the plans.

Advantages of Motor Trucks for Use on Steamship Piers

BY R. O. PATTEN *

Motor trucks have taken so essential a part in the transportation systems of every merchant or manufacturer that steamship companies have nearly all given up their effort to bar gasoline (petrol) vehicles from piers.

In many sections of the country there were, for a long time, rules that barred gasoline (petrol) trucks from piers. This was one of the conditions that had to be changed before Pierce-Arrow trucks could be used to their full advantage in all-around delivery service. It took a campaign of education finally to bring around officials to see the injustice and absurdity of this course, but the reform has been accomplished, and with few exceptions all piers now put gasoline (petrol) trucks on the same basis as all other vehicles.

The freedom of action now permitted has opened the way to a large saving of money and a big improvement of service for many truck users. No longer do such users find it necessary to have a combined delivery, part horse-drawn dray and part motor truck, as was necessary when gasoline (petrol) vehicles were barred from going on the docks. This often compelled hauling from the wharf to the warehouses by horses, and then changing the cargo and completing delivery to the purchaser by use of the power vehicle. This reloading cost valuable time and wasted money.

The truck receiving its load at the pier and taking it direct to the final destination is giving the ideal kind of delivery. The whole proposition is thus made direct and the reload is eliminated. Much that comes in to a pier can be handled in this way.

It is true that delivery problems at a wharf must always be complicated by some inseparable disadvantages. These affect all kinds of vehicles equally. Congestion of traffic deals no more kindly with a motor truck than a pair of horses. Both have to take their turn in line and stand there the same length of time. This lost time naturally involves a greater loss with the truck, whose first cost was far greater. But once on the wharf the truck can work all around the horse-drawn vehicle.

It is conceded that the truck is more costly while standing side by side in line with the waiting horses, but in the time spent on the pier, the advantage is all in favor of the truck, a result largely due to the great facility with which it can be maneuvered and its greater capacity. Add to this the greater speed between the shipping point and the pier, and it will be seen that the element of economy is with the truck, the proportion of saving increasing with the covering of additional distances.

Even for short haul work most users of motor trucks employ them for hauling to the piers.

* Truck Sales Manager Pierce-Arrow Motor Car Company.

Loading Dock of Freeport Sulphur Company, Freeport, Texas

At their mines at Freeport, Texas, the Freeport Sulphur Company recently completed a loading dock 250 feet long and 32 feet wide on which is a superstructure extending 44 feet above the level of the pier and tapering from a width of 20 feet to 16 feet. The pier is built of timber, the piles being creosoted and the superstructure treated with zinc chloride and painted with iron oxide and linseed oil.

Fifty-ton cars are loaded at the company's bins and delivered to the top of the pier by a 200 horsepower double Lambert hoisting engine 15 inches by 18 inches, which hauls the cars up the incline by a 1⅜-inch cable. From the superstructure the sulphur is discharged into chutes leading directly into the vessel alongside the pier. The chutes are telescopic and when not in use can be folded 4 feet within the clearance line of the pier.

This loading dock permits the loading of a 3000-ton vessel between tides. The structure is lighted by electricity and has water and fire protection. The Westinghouse, Church, Kerr & Company, New York, designed and constructed the pier as well as the entire plant for the sulphur company.

Timber Pier of Freeport Sulphur Company, Built by Westinghouse, Church, Kerr & Co., New York

Courtesy of New York Edison Company

Accumulation of Miscellaneous Freight on Pier Before Application of Electric Industrial Trucks. Wagons Blocking Roadway and Causing Congestion

Helping the Electric Stevedore

Practical Hints for Improving the Service of Industrial Trucks, Tractors and Trailers at Steamship Piers

BY H. C. YOST *

THERE is a widespread and general interest in the problem of handling material at railroad and steamship freight stations, but thus far this interest has confined itself to the broader aspects of the problem. As little if anything has been said of the ways by which the best results may be obtained from the equipment already in use, a few hints on helping the "electric stevedore" in its very exacting work may not be amiss. The following article, therefore, will discuss only the operation of industrial trucks, tractors and trailers, although portable hoists and conveyors really should work hand in hand, to show a saving in operating cost as well as giving greater speed and capacity.

The interest taken in the application of these little freight carriers to the task of handling all classes of material is growing rapidly each day, and as the automobile is fast supplanting the horse-drawn vehicle so will these electric stevedores supersede the hand trucks.

New York, the largest and busiest city in the world, is the most poorly equipped with freight-handling machines. More than half the commerce of the United States passes through New York, being distributed on the docks and piers and loaded from train to ship, or ship to train. In New York City there are at the present time less than 90 electric industrial trucks of about two tons' capacity, and not one single tractor, although the industrials are used as such. By far the greater portion of freight is handled by hand trucks.

Human power still reigns supreme in the carting of freight. Men are plentiful and are willing to work for a moderate wage. They are more or less shiftless, not overfond of this class of work, and are very unreliable; yet the longshoreman has always been a factor at the docks, and doubtless will be for a long time to come.

* Power Bureau, the New York Edison Company, New York.

Causes of Additional Expense Charged to Handling of Freight by Electric Stevedores

It is necessary to slow down loaded truck before it reaches gang planks to save breaking steering knuckle and battery jar. Freight tied on to prevent it from being shaken off truck. Inclines too short and steep and too narrow to allow trucks to pass.

Loading Merchandise Into Railroad Cars on Car Floats. Note Short Planks at Approach to Float Platform and Small Steel Plate at Entrance to Box Car

Yet with the close of the present war many, no doubt, will return to their native lands to engage in reconstruction, manufacture and farming. Shipping will certainly continue, longshoremen or no longshoremen, and the terminals will be unprepared to cope with the situation unless provision is made while the opportunity is at hand.

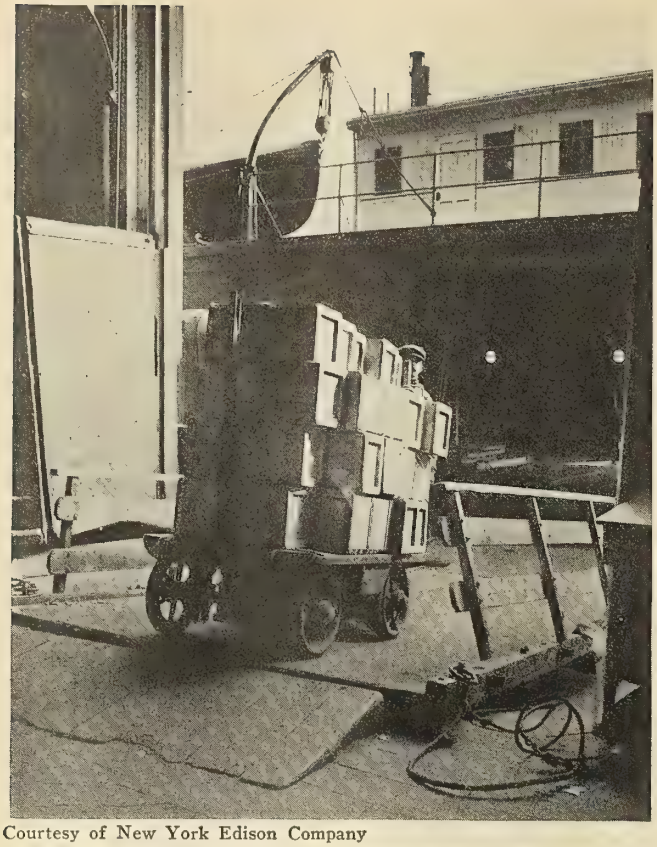
There are many who have no electric stevedores at present who say, "They may work to advantage on So & So's pier, but they cannot handle the class of freight we receive or ship." There are certain others who have tried industrial trucks and found them unsuccessful. There are still many skeptical people who, in a spirit of watchful waiting, are waiting to profit by the experiments and experiences of others. As to that class, which having tried the trucks and found them wanting, certain parts of this article are particularly dedicated. For it will probably be found that the principal reason for the so-called failure was a lack of helpfulness on the part of those in charge of the trucks.

Industrial trucks have a capacity of from one to two tons at a speed of about seven miles per hour. This is apparently forgotten when heavy loads are to be moved. Two to four tons are often placed on the platform or on a trailer, and the truck is called upon to "get away with it." The result is that long before the day is over the truck has lost its power and "pep." The storage batteries have been used up.

Use of Short Platform Trucks. Portable Scales Moved from Place to Place to Weigh Incoming Freight

Courtesy of New York Edison Company

Addition of Permanently Located Scales. False Platforms Raised Up Close to Ceiling After Freight is Removed. Short Platform Trucks Replaced by Trucks with Larger Platforms



Courtesy of New York Edison Company

Industrial Trucks Carrying Loads From Boat to Pier. Inclines Are Rather Steep and Approaches Abrupt

Then, too, there are the joy riders, who, having business at one end or the other of the pier, commandeer a truck to save walking. This may be all well and good when there is a load going their way, but deliberately to take a machine away from its work adds expense to the handling of freight, consumes useful energy from the storage battery and produces no adequate return.

As bad as the joy rider is the smart operator who tries to make the fastest time, whether with a load or traveling light. He comes racing down the pier and within a few feet of his destination jams on the brakes and makes a beautiful short stop. He is the one who also tries to skid around, especially when the pier surface is wet, to save changing his position or reversing the truck. He is the one who wears out the brakes, wears and tears the tires, overheats and sometimes burns out the motor, and runs down the storage battery. Is it any wonder, then, that the owners, not knowing of this abuse, condemn the electric trucks, saying they cost too much to operate and the upkeep charges are too great for the amount of work they accomplish?

Let us study the different classes of piers separately, considering first the railroad piers.

Equipment of Railroad Piers

The gangplanks, which are used to connect the car float platforms with the bulkhead sheds, are in many cases too short, making an extremely steep incline, and too narrow to allow hand trucks to pass one another. The ends of these gangplanks could be finished off at a more gradual taper, while thin iron plates securely fastened would afford ample protection to the ends of the boards.

The platforms on car floats should be raised to a mean car floor level and the plates at the door openings should be wider and cut at either 30 or 45 degrees, so a truck could go in or out without the ever-present danger of running off the plate. Cars should be shifted on floats so that the uprights, supporting the roof over the platform, would not come near the car door.

To carry out these recommendations would not cost much and would aid materially as well as financially in the handling of freight.

While the application of the industrial truck for freight handling to and from cars apparently has not met with much success in New York, in other cities they are used to great advantage. At present there are only four electric trucks used for this class of work. They are helping the situation, although they were never meant for such service. They are of the low-slung type, and when going over incline planks or uneven surfaces usually hit and bend, or break the steering knuckles, break the battery jars, or throw the steering lever out of the operator's hand. This particular type of steering apparatus—push and pull in a horizontal, instead of a vertical, direction—causes undue strains on the driver, catches in obstructions, and has been the cause of several injuries.

What, then, could be used to handle this class of freight?

Industrial trucks carrying from one to two tons, having a platform from 3 to 4 feet wide and a wheel tread from 2 to 3½ feet, could be loaded with freight, and, if kept within a width of 4 feet, could easily pass another truck with a similar load.

Tractors and Trailers Increase Capacity

Tractors having a capacity of from 2 to 6 tons and a width of from 3 to 3¼ feet could be used to great advantage for handling material to and from cars. These sturdy tractors pull from three to six trailers having a capacity of from 1,200 to 6,000 pounds each. The platforms measure from 2 by 3 to 3 by 8 feet. Two or three tractors could keep up a continuous flow of freight, the idea being to allow from nine to eighteen trailers to each tractor, depending on its capacity. While one-third are being loaded, one-third are in transit and the other third are being unloaded. Trailers could be dropped off at whatever car desired, where men would push them inside to unload or load, leaving the platforms clear for traffic. Very little time or money is saved by having the industrial trucks run into the box cars.

The loading and unloading of freight from cars to pier, especially at high or low tide, is by no means an easy problem to solve. Planks are laid and the incline is usually too steep for one man with a hand truck to negotiate. Planks should be built to flare out from the car door, be much longer, well supported and at least be wide enough for two trucks to pass.

The tractors could again be used to haul freight on trailers and push them up the inclines. The trailers for this class of work should be somewhat different from

Tractor Hauling Four Trailers Loaded with 4 Tons of Sugar

Application of Tractor and Trailers to Handling of Package Freight. This Type of Trailer Works to Good Advantage on Even Surfaces, but Is Not Applicable to Inclines Due to Platform Clearances

Trucks Carrying Freight to and From Box Cars. The Platforms Are Large Enough to Allow Trucks to Maneuver. Car Floor Is Level with Pier Floor

those at present on the market. They should be equipped with ball or roller bearings, wheels with either rubber tires, some resilient material, or perhaps tension and recoil springs, brakes and steering apparatus. The many advantages are apparent.

Piers for River and Sound Steamers

Let us consider next the piers occupied by river and sound steamships. These terminals are rapidly being equipped with industrial trucks, although some favor the tractors and trailers. The handling of package freight by any new method has been a bugbear to a great many people; still there are those who are devoting a great deal of time investigating and experimenting, and before long the difficulties will be overcome.

Bulkhead sheds at present are inadequate for handling the enormous quantity of freight that passes through each day. Some have additional platforms on which to store material when not quite ready for shipment, or until hand or industrial trucks can cart it away. After the freight is removed from these platforms, they are hoisted up close to the ceiling, out of the way. These have been superseded in some cases by smaller platforms, built at the same height above the floor as the industrial trucks, and furnished with castors. Instead of raising these, after material is removed they are taken to a convenient spot for future use. This change has led to many new ideas.

Courtesy of New York Edison Company

Loading Freight From Wagons to Electric Trucks on "the Farm." By This Method Part of the Congestion Is Relieved

Let us follow one box from the time it is received to the time it is put on board the steamship and see how many handlings it receives.

First the wagon delivers it to the receiving platform; second, it is moved over to the scales, where it is weighed, size taken, checked and receipt given; third, it is shifted to the false platform; fourth, loaded on the industrial truck, and fifth, from the industrial truck to stowing place on board the boat. Sometimes it is taken down the pier and left to await the arrival of the boat, which adds two more handlings, namely, unloading and loading on the truck. From five to seven times this box, or package of freight, is juggled around.

Application of Trailers

A proposition which would save this handling and rehandling of freight is the application of tractors and trailers similar to those previously mentioned. Instead of using the false platforms, put trailers there. This would save from two to four handlings. Tractors have a greater load-carrying ability and can haul from one to six tons of material on trailers. There is an ever-increasing belief that loaded trailers will be run on board the steamships and left there, so that when the boat lands at the other end of her journey these same loaded trailers can be run off, thereby saving the same amount of handling as spoken of before. The objections to such procedure are the space lost under the body of the trailer and the erecting of false floors over the main steamboat deck. There is no doubt but that freight could be loaded and unloaded much more rapidly, which means that boats could sail at more frequent intervals. This is where the money is made and is well worth serious consideration.

At present the farms, or space in front of the bulkhead sheds, are used for the storage of material, for wagons to unload either to industrial or hand trucks, or for wagons waiting their turn to go on the pier. It is well to keep as many wagons off the pier as possible; they take up space, block traffic, wear out the pier surface, and are in general a nuisance. If the bulkhead sheds are not large enough to receive the freight on its arrival, portable or permanent receiving stations can be located on the farm, duplicating those inside the shed.

Repairs to pier floors are made in a most unsatisfactory manner. If a plank has fulfilled its mission and is to be replaced, a 2-inch or 3-inch board is put down, where a 1½-inch plank would make the surface even. The edges

are poorly beveled, which causes a hard jolt in passing trucks.

Pier entrances in some cases are paved with unevenly laid cobblestones. Imagine anything worse than running over such surfaces. A thin mixture of concrete could be used to fill up the crevices, or at least a part could be laid out for trucking.

A little thoughtfulness on the above points would aid materially the speedy handling of freight and at the same time would reduce damage not only to the freight, but to the truck and operator as well.

There are at present thirty-six industrial trucks operating on piers occupied by river and sound steamship companies, and before long there will be several tractors used for the handling of this class of shipments.

Next are the piers occupied by coastwise and transatlantic steamship companies. These piers have the largest equipment of industrial trucks; about forty-five being in operation at the present time, although many are giving the tractor and trailer proposition serious consideration.

Industrial trucks rarely carry freight through the side ports of the ship entering the port of New York. The ports are too small and are either too high or too low from the dock level to allow for such procedure.

The loads are usually lowered from the ship to the industrial truck, and then carried to various places on the pier or farm. The use of trailers, at the present time, attached to trucks shows the desirability of tractors for certain classes of bulk material. There are many commodities that could be carried on the truck's back, but are given to the men. It is, indeed, a sad sight to see from 200 to 300 men burdened with heavy bags of material on their heads and shoulders, struggling in and out, then up inclined planks to deposit their loads on one of the various piles.

Sorting platforms could be placed where the cargoes are landed and from there loaded on waiting trailers which would be picked up by tractors and taken to their respective places. Here a portable piling machine could be used to great advantage.

Better use should be made of the bulkhead sheds. Instead of placing storerooms and repair shops along this space, let the teams use it for discharging or receiving freight.

Old-fashioned "dollies," without roller or ball bearings (usually the iron bearings are so worn that the wheels wobble in every direction), constructed of heavy lumber, and weighing so much that it is about all a man can do to move them, are coupled to an industrial truck, which consumes useful energy in overcoming friction, to say nothing about the tracking qualities. Here a well-built trailer would carry a much heavier load more speedily and at a greater saving in cost.

A very optimistic spirit exists among the members of coastwise and transatlantic steamship companies, and more credit should be given them for the way they have co-operated with truck manufacturers to show the electric stevedores to their best efficiency.

The above cases are a few of the many obstructions that impede the progress of electric stevedores. If they were remedied, they would aid the many companies in relieving the congestion that exists on the docks and piers of New York City. The building of two-story sheds, so that freight could be unloaded from the ships on the upper floor, and loaded on the lower floor, would also expedite the handling of cargoes.

There are a great many tenements and old buildings opposite the docks and piers which could be purchased by the railroads and steamship companies, and modern warehouses erected. This would remove a large quantity of freight that litters up the piers, and would save carting expense to and from warehouses, as is now the case.

In view of the present and future conditions of the terminals, more thought and consideration should be given to the application of "industrial trucks and tractors and trailers," to help solve the problem of handling freight.

Portable Loading and Unloading Machines for Marine Terminals

Application of "Brown-Portable" Machines to Wide Variety of Uses in Loading and Unloading Package Freight

BY HARWOOD FROST *

One of the most costly items of transportation, and one that is not likely to be always taken into serious account by the consumer, is the expense of loading, unloading, trucking and piling of the commodities during their passage from producer to consumer. The packages are piled, taken down and repiled in warehouses and on docks; they are loaded and unloaded into and from cars, boats and wagons over and over, and much of this work is done today by ordinary derricks and trucks and by the same slow, expensive and unreliable hand methods that were used by the Egyptians of four or five thousand years ago. These antiquated methods and their consequent high costs in the handling of the commodities resulted in the development of the "Brown-Portable" line of portable and sectional elevating, piling, conveying, loading and unloading machinery for the economical handling of materials in any form of package.

In nearly all these branches of transportation of packed goods, "Brown-Portable" machines have proved of service: the elevators are used to pile the goods in storage to await shipment; the sectional conveyors carry them into warehouses and across wharves; the portable loading and unloading machines put them into cars, take them out of cars and out of barges in the rivers and put them into steamers.

For some years the use of these machines was confined to the grain industry of the Pacific coast, but during the past few years their use has been extended to the handling of all kinds of commodities and materials in bags, bales, cases, barrels, rolls and other forms of packages. They are now used in mills and warehouses to handle fertilizer, sugar, wool, hay, straw, cork, rice, cot-

* President, Brown Portable Elevator Company, Chicago, Ill.

ton, lime, oil, paper, feed, kegs of nails and bolts, spools of barb wire, rolls of fence wire, carpets and rugs, kegs of beer, cases of canned goods, cartons of glassware, and a great variety of other commodities, with an average saving over hand methods of from fifty to eighty-five percent.

The accompanying illustrations show a few interesting types of "Brown-Portable" machines recently installed in connection with freight handling to and from boats. These are suggestive of the wide flexibility of this class of machines, and show how their portability and their adaptability to local conditions make possible their successful use under circumstances where more cumbersome and expensive stationary equipments would prove useless.

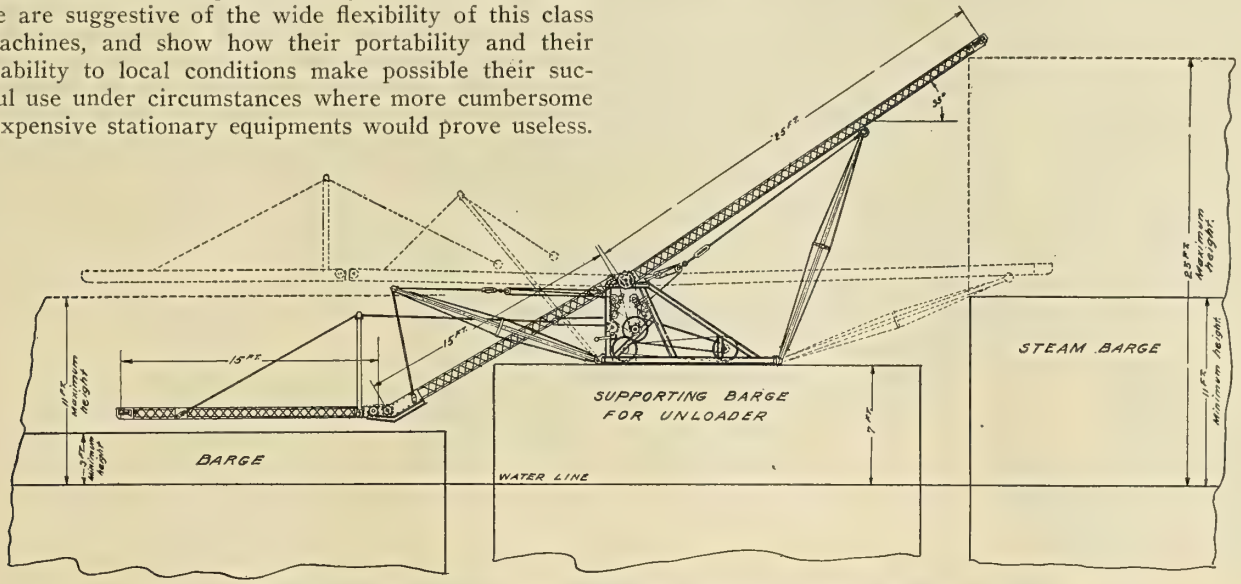


Fig. 1.—Three-Section Machine for Transferring Sacks of Grain From Barge to Steamer

Fig. 1 shows an unloader consisting of three sections, for transferring sacks of grain from a barge to the deck of a steamer. The lower carrier is jointed and all carriers are adjustable, by means of gearing operated by the motive power of the machine, to various heights and angles as may be necessary to take care of all variations in the height of either the barge or the steamer.

Fig. 2 shows an equipment made up of two parts used for transferring sacks from a floating elevator to cars on the shore. The grain is sacked at the top of the elevator and delivered to the receiving carrier of the unloader, then transferred across the intermediate supporting boat over two carriers and delivered to the car by means of a combined carrier and chute. This unloader is made in two sections so that the delivery carrier of the left-hand section can overlap the receiving carrier of the right-hand section, thus permitting the machine to be used on boats of different widths, and to adjust itself to the varying tides and heights of the boats.

Fig. 3 represents one of the latest and most useful types of carriers made by the Brown Portable Elevator Company. This equipment consists of several conveyor sections with power mounted on overhead frames, one of these conveyor sections being supported on a ramp, or hinged platform, which is adjustable to meet the requirements as to the varying heights of different boats. The conveyor carriages consist of steel axles, part being of a concave shape, and part a combination of straight axle and apron slats, the concave portion handling barrels, rolls, etc., the apron portion handling bags, boxes, bundles and loose pieces of hardware, etc., while bales of cotton

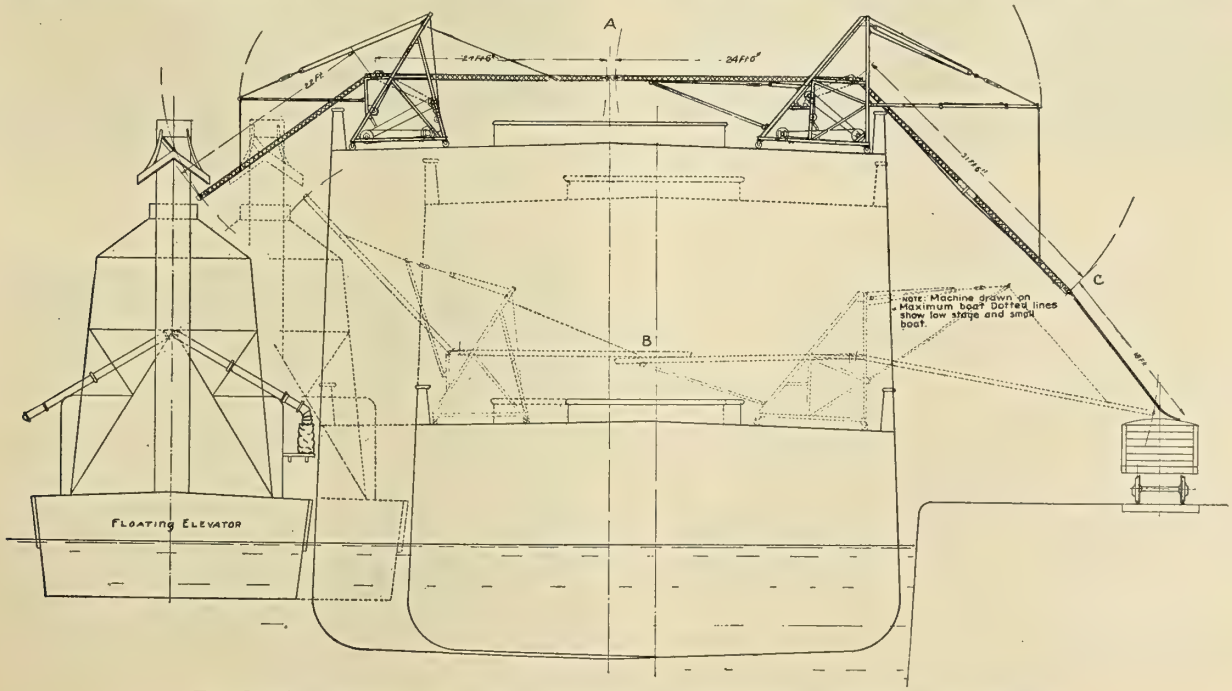


Fig. 2.—Apparatus for Transferring Sacks From Floating Elevator to Cars on Shore

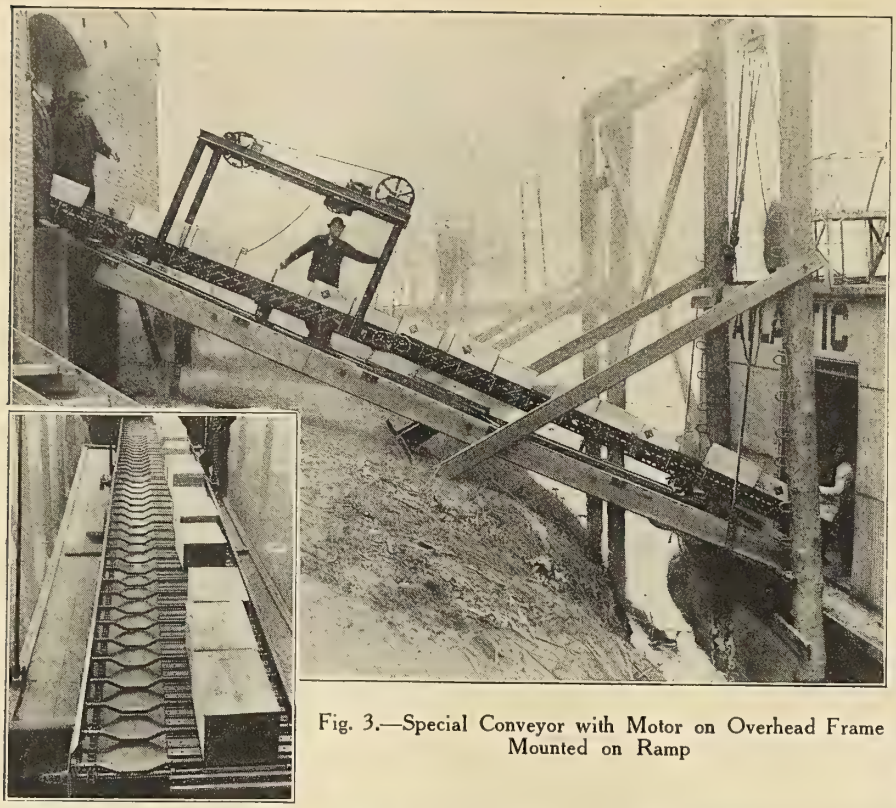


Fig. 3.—Special Conveyor with Motor on Overhead Frame Mounted on Ramp

and other bulky packages extend the full width of the conveyor. In its first trial in the unloading of a general cargo boat covering a great variety of commodities, this conveyor showed a reduction in the cost of handling of from 40 to 18 cents per ton.

Fig. 4 shows a special heavy type of portable conveyor made up of 18-foot sections used for both loading and unloading rolls of paper weighing 1,800 pounds. One portion of the machine is carried on the boat, while other sections remain at the receiving and discharging terminals. Either of these sections can be connected with the boat section in a very few minutes, and the heavy rolls loaded or unloaded at the rate of three per minute.

Another example consists of a portable unloading conveyor installed by the New Orleans Port Commission for handling bales of cotton, barrels of molasses, bags of sugar, coffee, etc. This conveyor receives the packages on the boat, carries them up a 20 percent incline to a distance of 115 feet, delivering them on electric trucks in the warehouse.

The "Brown-Portable" machines are made for many purposes and for the handling of a great variety of packages. Many instances could be cited of the special uses of these machines in the various industries, and of special combinations showing the elasticity and adaptability of the system, as well as the great saving in labor and time effected, but it is sufficient to say that there is scarcely a condition in the handling of goods in any form of package in and about marine terminal warehouses that cannot be met by the "B-P" system with an appreciable saving over the cost of handling the same goods by hand, derrick and truck.

Loss of the Memphis.—The United States armored cruiser *Memphis* was driven ashore at Santo Domingo City by a terrific ground swell during a sudden tropical storm late on the afternoon of August 30 and became a total wreck. Reports of the disaster indicate that the failure of the main steam pipe made it impossible to maneuver the ship away from the shore during the storm, and a number of the crew in the engine room staff were seriously injured. The *Memphis* was built by the William Cramp & Sons' Ship and Engine Building Company, Philadelphia, Pa., and was commissioned July 17, 1906, as the *Tennessee*. She was of 14,500 tons displacement.

Fig. 4 (a).—Section of Machine on Boat

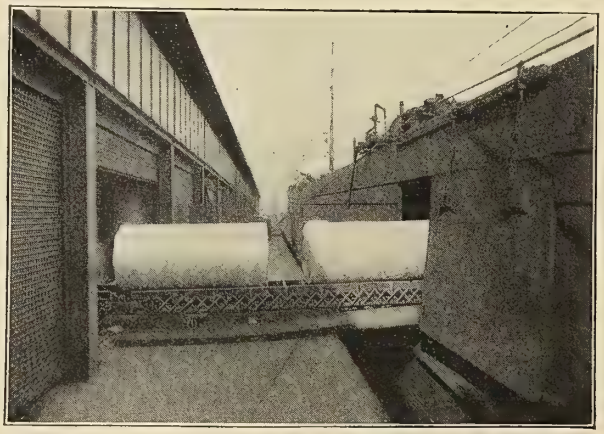


Fig. 4 (b).—Section From Boat to Pier

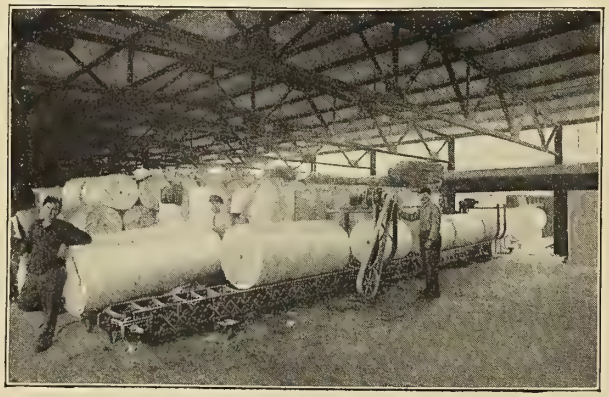


Fig. 4 (c).—Discharge Section in Pier Shed

Berths 1 and 2, Woolomootoo Bay, Sidney, New South Wales. Cargo or Transit Shed, 580 Feet by 60 Feet, Is For Assorting, Distributing and Temporary Storage Only

Competing Marine Terminals at Seaports

For Pre-eminence in Shipping, Seaports Must Provide Better Terminal Facilities—Lessons From European Cities

BY H. MC L. HARDING *

THE commerce of the United States for the year ending June, 1916, was $6,525,000,000 (£1,338,000,000). The exports increased $1,576,411 (£323,500) and the imports $541,025,000 (£111,000,000). These figures far exceed those of any country in the history of the world.

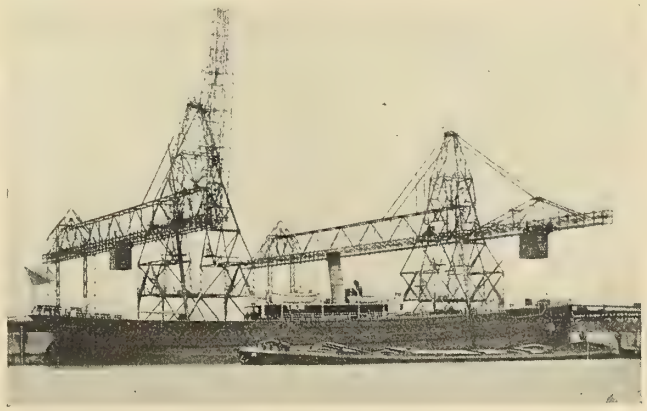
This enormous commerce is largely due to the war in Europe. Much of it, however, will remain if besides the low cost of production due to manufacturing in large quantities there be a low cost of water transportation with a correct physical preparation for the transference of the cargoes quickly and economically through the port terminals. Much of this commerce belongs to the United States on account of the raw material, the natural products from the farm, wood and mines, and the present wonderful facilities for manufacturing. All industries have received a great impulse during the last two years.

This still increasing commerce must pass through the gateways of port cities to reach the profitable markets of the world, which have been so lately developed and opened to the merchants and manufacturers of this country. Wherever the new gateways for the outflow and inflow of commerce are located, there will arise the richest and most populous cities of the United States. Those gateways will be pre-eminent which possess natural advantages, which can be developed most quickly and which have the fewest physical and political drawbacks to be overcome. The farther inland the port the less the rail haulage and the greater the possibilities.

For example, there can be no doubt as to the future of Albany, N. Y. This city has been handicapped in the past. Its manufacturers have not had the same opportunity that they would have had could ocean-going ships have been able to berth at the new concrete quays of this inland terminal. If a manufacturer there located desired to send goods to foreign countries, he must first pay the water or rail transportation expense to New York, and then the great terminal expenses of rehandling and of transference and probable barge transshipment at the port of New York, which port is by far the most expensive

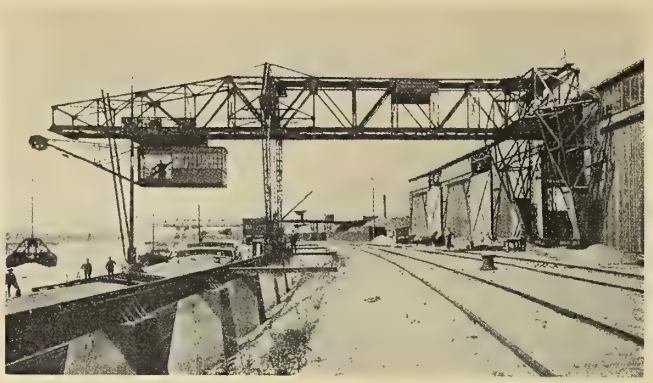
* Consulting Engineer, New York City.

Pier Sheds at Port of Sydney, N. S. W., Set Back from Water's Edge. Movable Platforms Receive Goods for Second Story. Eight Gantry Cranes Have Been Ordered and Four Are Assembled



Plant for Handling All Kinds of Freight at European Port. Working Speeds, Lifting 240 Feet Per Minute; Trolley, 660 Feet Per Minute; Bridge, 80 Feet Per Minute

Traveling Electric Bridge with Trolley and Grab Bucket



Traveling Bridge with Jib Crane Beneath, Transferring Freight from Barge to Warehouse

harbor known to commerce. As these expenses are preliminary to the steamship rates, is it any wonder that his profit was greatly reduced? It does not require much business acumen to see that this condition could not continue long, even had there been no war to stimulate business and foreign commerce.

It can be asserted without contradiction that there must be many inland terminals if the greater proportion of the trade of the world is to be secured. Unless there be a change in port facilities, the greatest restraint of foreign trade will be the high expense of obtaining raw material and of the shipping of finished products to the markets of the world, and not a small proportion of this expense will be the terminal charges, especially when there are several rehandlings by manual labor, which is ever increasing. The high transportation cost does not signify that the railway rates are too high, but that on account of such long distances from many factories to a seaport with facilities and ships it is difficult for the merchants and manufacturers to expand according to their other opportunities. There should therefore be many new seaport terminals established as near as possible to the place of origin of the finished product.

What New York Lacks

It is said that the port of New York has at present superior facilities due to the railways and ships having terminals about the harbor. At all events, although it has expended millions for port improvements, it has a profit from its port operations of nearly ninety millions of dollars above all expenses. For Manhattan, of the city of New York, there may be the following criticisms.

The piers are not equipped with machinery so that the port can compete with foreign ports, as to economy and speed in the transference of cargoes. The above expense is more than double that of Germany for the same service. On this account, for which there is no logical reason, the manufacturers of the United States using the port of New York are at a great disadvantage and handicapped at the very beginning of their adventure into the field of foreign trade.

New York is acknowledged to be one of the most expensive ports of the world for the transshipment, transferring, handling and rehandling of freight, excepting only those which have not sufficient deep water to berth alongside quays or piers. When over 40,000 freight cars from all over the country have been held at one time on the New Jersey meadows for days, some from such remote points as Texas, and when such railroads as the Pennsylvania, the New York Central, the New York, New Haven & Hartford, and many other roads put an embargo on freight, refusing to accept any more goods or products for New York, the necessity for the development of many other ports needs no argument.

There are being built new terminals along the Atlantic and the Gulf of Mexico. Some of these will overtower the others. Which cities will have the greatest terminals?

The most successful city-owned port in each State with the best terminals will become the metropolis of such State. Such is almost universal history of great modern cities.

By what means can a city secure this pre-eminence and attract to itself the business from shippers, consignees and shipowners? How can it compete with existing ports and divide with such ports the ever-increasing new foreign commerce and obtain its share of the old?

The answer is not difficult. Provide better facilities than those of the older ports.

In what do these facilities consist?

Marine Terminal Facilities

1. That class of construction which will avoid interruption of commerce, either by fire, epidemics or by continual repairing—that is, make the quays or piers fireproof, rat proof and decay resisting. The quays and piers above mean low water should be of concrete construction. Such is the construction of the new quays at Beaumont, Tex.

2. Provide transferring and handling machinery which will be equal to, if not better than, that of any foreign port terminal. Such a port will be several times more efficient than any of the larger port cities of the United States. There is no doubt but that the American engineers as soon as the demand arises can and will surpass the best abroad. To secure a superiority over other competing ports, it is essential for such a city to be in the van in the construction of its terminals and in the installation of machinery, and not come trailing after nearby

Full Arch Gantry, Traveling Bridge and Grab Bucket. Jib Crane Above Bridge

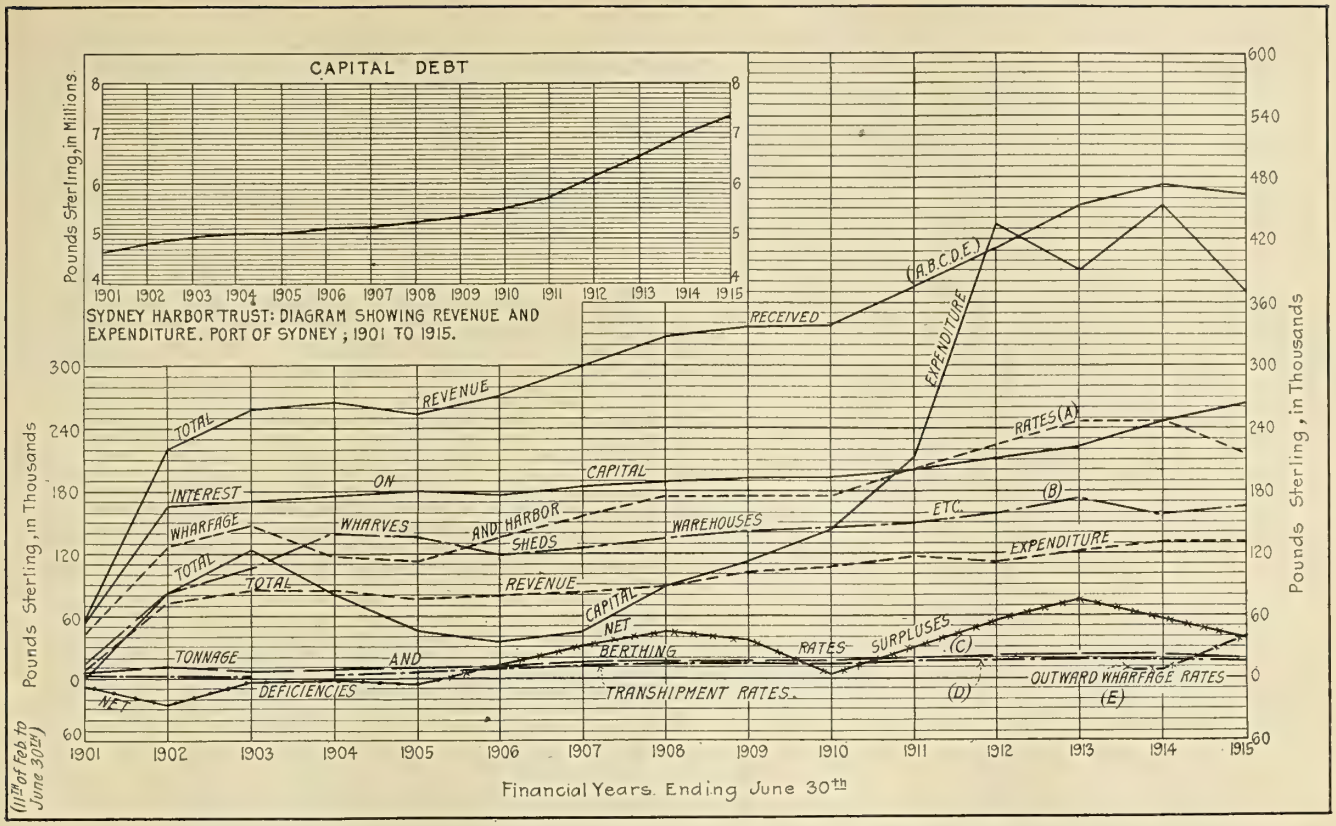


Diagram of Revenue, Expenditures, Surplus, Interest on Capital, Wharves, Wharfage, Warehouses, Tonnage Berthing and Rates at Port of Sidney, New South Wales

cities. The city which acts first will lead. Copying successful foreign ports and adapting their facilities to American conditions would put any American port far ahead in the competitive race.

3. It is necessary to have the closest railway co-ordination between ship and shore. Outbound goods must be directly loaded by machinery from car to ship and inbound goods from ship to shed.

4. Congestion at the point of deposition or elsewhere cannot be allowed, if speed of unloading is to be attained. It is this absence of congestion which comprises the superiority of the crane over the ship's winch.

5. There should be at the terminal not only steel sheds for assorting, distributing and tiering the cargoes, but also concrete warehouses for long storage.

There are many other terminal essentials, but only a few are given.

To help make the above description clearer, a few views of foreign ports are given, showing types of construction and the kind of equipment. It should never be forgotten that the investment in terminals is not a source of expense to a city, that is taxation, but besides the terminal being self-supporting, it is also a source of income. Its bonds are even in a more desirable class than water bonds. This does not apply to an incorrectly designed or poorly constructed terminal.

The following have been so universally accepted as to have become proverbs:

Commerce of City Dependent on its Terminals

The commercial future of a seaport city is dependent upon its terminal facilities.

Transportation efficiency to-day is a terminal problem, the main purpose of which is to secure an adequate development of terminal facilities for the transfer and handling of freight. That city which, through low terminal cost and high terminal speed reduces transportation expense, not only facilitates commerce but creates commerce and manufacture for the state and an enviable position for itself through its increasing population and prosperity.

The trade of a city is great as the city develops facilities for the flow of commerce through its gates, and its possible supremacy as a trade power depends upon its transportation efficiency.

This transportation efficiency has long been recognized by those countries which have been the leaders in foreign commerce, and their main purpose has been to obtain the utmost development of their terminals for economical and rapid transfer between vessel and shore. If a city will observe the above and possesses the following qualifications, the only limit to its growth is the growth of the nation.

The following are a few of the conditions necessary for a great industrial terminal, and then for the greater city:

Requisites of Industrial Terminal

1. A rich hinterland, rich in the possibilities of the products of the earth and of manufacturing.

2. Rail connections and a possible increase of such connections, including a terminal belt line and rail service to all parts of the terminal, to the city and to all territory tributary to the terminal.

3. A harbor and terminal site near the business center of the city for the industrial terminal, with control of possible future extensions.

4. A second location for a commercial or through terminal.

5. Low cost of harbor development proportional to that of other cities.

6. A navigable channel to the ocean.

7. A population, energetic and full of faith as to the future of their city, and as one unit as to its development in the fruits of which all will participate.

8. An important condition is to have a city-owned and city-controlled terminal. That is one that belongs exclusively to the people. This possession by the city of the terminal will render a city independent and prosperous, while a privately owned terminal will rather contribute loaves to the interests of the corporations, while the people may have the crumbs that fall from the table. There are too many examples of this.

9. Correctly designed piers and quays furnished with fireproof sheds and warehouses and completely and properly equipped with freight transferring, assorting and distributing machinery.

10. Near location for railway tracks for extensive car shifting, classifying and storage.

11. Land for manufacturing lofts, which should be under the control of the terminal.

A city is most favorably situated if possessed of all of these advantages, a combination difficult to be surpassed. Such a port should preserve and not part with its inherent rights. This is an important condition of supremacy.

Competition Between Terminal Ports

Competition between terminal ports should be of a most friendly nature, for the prosperity of each will redound to the advantage of the whole country. A fair and equitable competition will help both cities to advance and will unite them for a possible common cause and interest. The harbors on the River Rhine, Germany, are examples of what such competition will accomplish.

As is well known, proved by experience and established by many figures, quays, piers and sheds correctly planned and properly equipped with machinery for the freight movements without and within the sheds, will have from two to three times the transferring and handling capacity, than if not so designed and equipped.

This means that an investment of $250,000 (£51,300), including mechanical equipment, would be equivalent to an investment of about $750,000 (£153,700) not so equipped; or one foot of lineal quay wall frontage with machinery would be equal to about three feet without machinery; or if over one foot of frontage without mechanical appliances 150 tons can be transferred per annum, then with appliances at least 450 tons can be transferred in the same time. To secure these results with the attendant economy all congestion points must be eliminated.

The port terminals of the English colonies are often better types of construction with modern facilities, appliances and methods than those of Europe, and are in many respects more valuable for American engineers to study. It is better not to measure ourselves by our own measure—that is, by what has been done at some nearby terminal, but to be familiar with many ports in various countries, and thereby select from each the best.

In connection with the financial statements of these port expenses, as for lightships and lighthouses, beacons, buoys, dredging and the numerous other harbor charges which in the United States are borne by the Federal Government, these are all paid by the Harbor Commissioners from the port income. From such payments the ports of the United States are free.

In the analysis of the financial statement of the Port of Sydney, New South Wales, for the year ending June 30, 1915, are found facts of instructive interest. The revenues for the year were about $2,260,000 (£464,681). The working expenses, including commissioners' salaries, amount to $650,000 (£133,156). The ratio of working (operating) expenses to the gross receipts is only 28.65 percent. The capital investment to June 30, 1915, was $36,000,000 (£7,367,922). The rate of interest charge for the year was 3.6694 percent. The gross revenue yielded a return of 6.47 percent on the capital. The surplus revenue account and the sinking fund balance made the accumulated surpluses from February 11, 1901, as $1,740,000 (£353,472). The sinking fund is $865,000 (£177,012). This is the remainder after paying all operating expenses (salaries), interest, renewals and replacements.

The statement is thus given to show that port terminals in themselves form a good investment with most excellent security. The above figures and many others are given in detail from the beginning of the port to June, 1915, in the attached diagram and also the tonnage year by year. This diagram would be useful as a model and is a complete record in itself.

Besides the data from the port of Sydney, New South Wales, the reports from Columbo on the island of Ceylon, and those from Calcutta, Bombay, Madras, Rangoon, and other similar ports as to their functions, value of property, liability, powers, annual revenue and expenditure, can be studied to advantage. In their port development these cities have been obliged to investigate closely questions as to physical construction, equipment, investment, income and administration, the same as any American city would be obliged to do, when establishing new city terminals. In this general article it is possible to give only the names of such ports.

Conclusions

1. In the competition between port cities a city whose terminals are largely privately owned and controlled cannot successfully compete with a city whose terminals are owned, controlled and operated by the city and for the people.

2. Any city which hopes to secure its share of domestic and foreign commerce and to become the metropolis of its state must build permanent and fireproof quays and piers and such as will not be liable to an embargo on account of an epidemic.

3. No city and its hinterland, with its factories, mines and farms, can even hope to hold its present position if a large seaport, or to attain to its rightful heritage, unless it provides the terminal facilities, as sheds for temporary holding, and freight-moving machinery to attract the shippers, consignees and shipowners, and have available warehouses for long storage.

4. Its chances of holding even a rear position in the race for supremacy is small indeed unless it has complete co-ordination between rail and shore according to the best designs and plans.

5. No city can reach the goal of its ambition as a marine port terminal unless it offers all the mechanical appliances methods and facilities of the successful ports of the world.

Monthly Shipbuilding Report.—The Bureau of Navigation, Department of Commerce, reports 123 sailing, steam, gas and unrigged vessels of 50,739 gross tons built in the United States and officially numbered during the month of August. Nine of these vessels were steel steamships, aggregating 35,097 gross tons. The largest vessel built was the *D. G. Schofield,* of 8,651 gross tons, built for the Standard Oil Company at the Union Iron Works, San Francisco, Cal. Three other vessels of over 6,000 gross tons were completed during the month, including the *Emory L. Ford,* of 7,986 gross tons, built at Lorain, Ohio; the *Antwerpen,* 7,955 gross tons, built at Newport News, Va., and the *J. M. Danziger,* 6,487 gross tons, built at Philadelphia, Pa.

Freight Handling Through Unoccupied Terminal Space

Utilization of Hitherto Unused or Waste Space Over Storage Piles for Mechanical Transference of Freight

BY S. H. LIBBY *

The prime results desired in loading or discharging ships are:

1. Reduced manual labor.
2. Reduced time for loading and discharging.
3. Reduced port charges by reduced cost of handling between vessel's rail and storage.

All others are correlated or of secondary consideration. This is the result of the increasing scarcity of the class of labor heretofore utilized, the growing necessity of reducing the unproductive time in the life of the carrier itself, be it steamer, car, or what not, and because of the increasing value of wharf area.

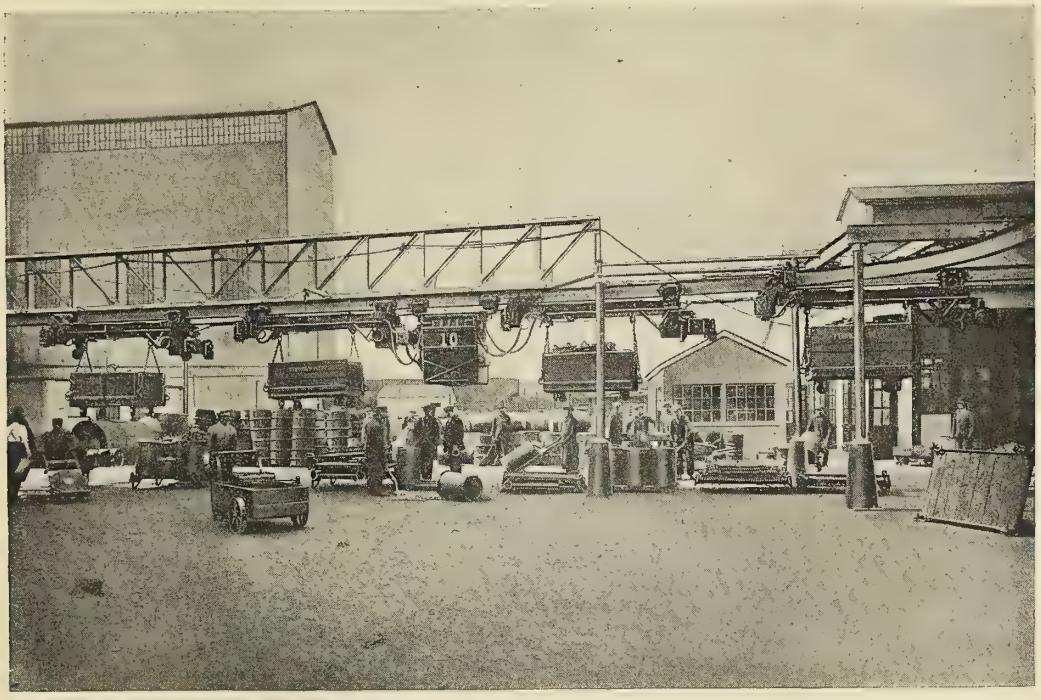
There is a growing scarcity of good muscle, and whatever the cause it need not be considered, as the fact that it exists is sufficient to bid us pause and give the subject serious consideration. Not only is the quality lacking, but the quantity as well, and the lack is felt in all industries where reliance has been placed on such labor in the past. This lack of labor calls for the use of such machinery on our river front as will utilize manual labor in the smallest degree, in fact it must be real muscle-saving machinery, of a character which will not only hoist or lower the freight between wharf and vessel's hold, but must transfer, tier and reclaim.

It must not only carry at a much less expenditure of what we might call muscle units, but it must do so at a greatly increased speed, reducing the time required per ton-foot between the vessel's rail and car or truck, and thus solve the second of the problems with which we must deal.

The reduction of time carries with it not only a reduction in cost of the actual handling of the cargo, but a reduction in cost of carrying by reducing the idle time of carrier, or the time during which it is in port and used as a warehouse only.

The increase in size and cost of ships makes it essential that everything be done in the way of transferring cargoes which will tend to decrease the time the ship remains in port. As the cargo vessel is built primarily as a carrier and not as a storage warehouse, it is of course necessary to reduce the time to a minimum during which it is used for storage—that is, waiting to load and discharge, and actual time of loading and discharging. Thus, too, the truck, freight car or whatever is to take the cargo to or from the dock must be kept performing its duty of carrying as much as possible in order to fulfil its economical function, and therefore must be loaded and discharged in the shortest possible space of time.

In order that the carriers of either class may be kept moving as much as possible without regard to the movement of the other, there must be an elastic medium or reservoir both ways between the two classes of carriers, and it must be supplied in the form of storage space, such a reservoir admitting of relieving the carrier of its load,



Hoists, Monorail Cranes and Electric Storage Battery Trucks for Handling Miscellaneous Freight

* Engineer, Sprague Electric Works, New York.

if the receiving carrier is not ready to take it, the wharf or pier with its shed acting as such a reservoir.

In these days, when conservation is such a frequent theme, although so little practiced, the utilization of unused or unoccupied space is a thing much to be desired. The fact that floor area costs something, due to first cost of land and buildings, and maintenance charges, is a real incentive to the conservation of space and to the utilization of the present unused space. What is the value of our floor space from a productive standpoint? That is, what is the shop cost of our storage per square foot of floor space?

Conserving Floor Space

Analysis will show that it is sufficiently large as to become an important factor governing the design of the terminal, and as the reservoir capacity is a necessity it must be provided at as small a cost as possible, both as to ground area which it occupies and the cost of storing and recovering the material. Every square foot of floor space used for transferring, which could be used for storing, if some other means were used, is a liability rather than an asset, for the fixed charges must be borne by the area which is used for storing. If we work out a ratio of the used to the unused space in such a plant, we would undoubtedly be astonished at results which will reduce our assets and increase our liabilities to an unbelievable extent.

In a port where cargoes are loaded, discharged and stored within a stone's throw of multi-storied office buildings, the same necessity for an economic use of the ground area would seem to exist where it is used for dock purposes. Terminals as generally observed to-day do not utilize more than 50 percent of the ground area in the storage of material, and this storage or reservoir must exist in order that the carrier may be on the move as much as possible.

How Wharf Area is Wasted

In nearly every case transference has to be accomplished by a means which calls for the use of 50 percent of the wharf area for its accomplishment, leaving a like amount for storage, resulting in a gross waste of wharf area, and in many cases the means employed seem based on the general idea that the more muscle units used the better the result, thus insuring the stay of the ship in port, where it is earning nothing, for the longest possible time.

Taking the unused floor area occupied by gangways left for trucking in conjunction with the unoccupied headroom due to difficulty in piling, and the unoccupied space runs in most cases to more than 75 percent of the total space occupied by the shed. If, now, we can accomplish transference through part of the unoccupied space, and also pile by means of our handling apparatus, this condition might be reversed, the unoccupied space being reduced to 25 percent and the capacity of the building be increased threefold.

Thus the method for increasing the capacity of the present floor area which would naturally first present itself would be to accomplish the movement of the material through unoccupied or useless space and the increased speed which is so desirable would also be accomplished by the rapid movement of small units through such space.

In order to bring this increased reservoir capacity of ground area to its maximum the useless or unstored space will be reduced to a minimum by utilizing the space over the stored material for moving material to and from the rail of the ship, and leaving as unused or unstored space only sufficient floor area in aisles to admit of parts of storage piles being reached, but with no space left for moving the material between the piles. This not only calls for all lateral movement taking place over the tops of the storage piles, but must admit of any part of the ground area occupied by the shed being reached by the transferring apparatus.

By utilizing for transference the useless or waste space over the storage piles the material may not only be moved more rapidly, but, if the system be correctly designed, it may be taken in a more nearly direct line between receiving point and delivery point, which movement in itself constitutes a means whereby increased speed may result.

The advantages to be gained by utilizing the present unused space over the storage area for the transference of material are so many and so evident that the design of the most efficient marine terminal must of necessity include a system which would operate in that space and combine the area covering features of a bridge crane with the rapid, frequent, small unit movement of the monorail crane, and its use calls for not only the modification of our typical dock shed, but a radical modification in the system which now obtains, both clerically and as to supervision.

It has been said that "the immediate problems have to do with the installation of mechanical apparatus in present terminals," but the desired results cannot be obtained in that way, as the many trials and rejections attest, and until it is fully realized that not only must the apparatus be designed for the terminal, but the terminal for the apparatus, there will be a crying need for means whereby labor, time and cost of handling may be reduced at our port terminals.

Hunt Trucks, Tractors and Trailers

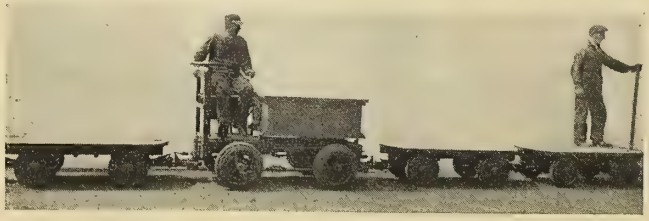
BY G. K. JENCKES *

THE enormous tonnage of freight being handled over the piers of the steamship companies and the difficulty of securing the necessary labor at a reasonable price, naturally brings to the attention of the owners the question of labor-saving devices to accomplish this work more expeditiously and cheaply. Many systems of machanical carriers have been suggested and tried with varying degrees of success, but the test of time has shown that the electric storage battery truck offers one of the best solutions thus far developed.

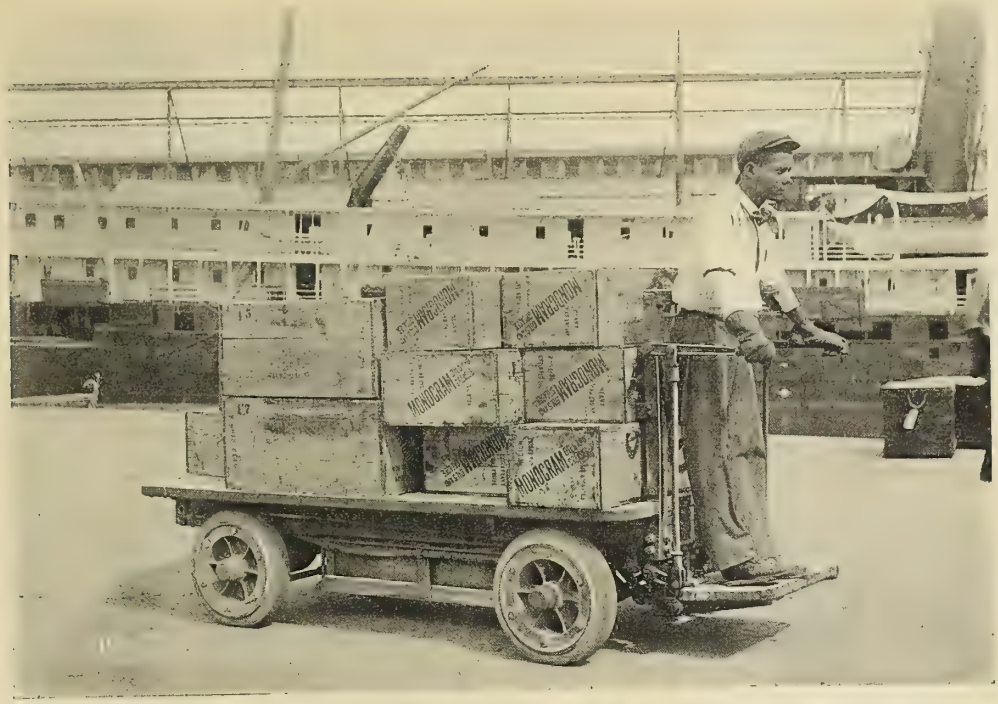
A brief analysis of the situation shows why this is so. One of the first things to contend with is the variation in the size and hatch arrangements of the steamers to be loaded and unloaded. This precludes the installation of fixed overhead carriers. Next the rise and fall of the tide complicates the situation so that carriers fixed in the vertical plane are rendered difficult or impossible to install.

Then there is the problem of handling a mixed cargo, which may be either in bulk, bags, barrels, bales or boxes.

* With the C. H. Hunt Company, Inc., West New Brighton, N. Y.



Hunt Tractor Pushing Two Trailers and Pulling One, the Whole Train Being Steered from Front Trailer



One of Fleet of Twenty-one Hunt Trucks used by U. S. Government at the Panama Canal

A conveyor to transport boxes of eggs is not well adapted to handle bales of cotton. Owing to the stowing of the cargo the material will always enter or leave the ship in a mixed fashion which prevents the use of different types of conveyors for different classes of goods.

When we take up the question of distribution of the freight on the piers we have reached perhaps the most important consideration of all, for a successful mechanical device to perform this service must be able to take the freight from any one point to any other point. This must be done without taking up valuable floor space which is available for storage purposes.

In brief, the keynote of the whole problem is flexibility. In the past this has been obtained by the two-wheel hand truck and is the only quality it has to warrant its continued use. Bearing in mind these facts, the substitution of a small power operated truck for the hand truck is a logical and rational development.

The above shows some of the reasons for the existence of the electric industrial truck, or, as it has been aptly termed, the "electric stevedore." This little machine, with a speed of around eight miles per hour and a carrying capacity of 4,000 pounds, enables one man to do the work of from eight to twelve men with hand trucks, depending on local conditions.

The accompanying illustrations show the type manufactured by the C. W. Hunt Company, Inc., West New Brighton, N. Y., in operation at various piers along the waterfront of New York harbor. These trucks, operated in fleets of from four to eighteen, have all paid for themselves in from four to six months' use.

As the familiarity of the users with possibilities of the electric truck has increased, new methods have gradually developed, the principal one of which has been the use of trailers to be drawn by the power unit. This is a particularly valuable arrangement when it is necessary to leave the load standing for any length of time. To meet this need the C. W. Hunt Company, Inc., has developed a trailer which is of unique design.

In order to secure economy of operation it is necessary for the power unit to pull several trailers. When this is done it is at once apparent that some method of construction must be used which will cause the trailers to follow in the tracks of the leading unit of the train. This has been accomplished with a fair degree of success by some manufacturers by the use of flexible connections, such as chains, etc. However, a train like this cannot be backed up and is a dangerous thing to handle on steep grades, as it will crumple up.

The trailer which has been developed by the C. W. Hunt Company, Inc., is so constructed that a train can be operated in either direction at full speed and the individual units will at all times track with the leader. To realize the great advantages of this device one has but to watch a driver of a horse-drawn wagon, to the end of which is attached another wagon, try to back up.

Steamship Terminal Service at the Pacific Coast Steamship Company, Seattle, Wash.

Hoisting Equipment for Marine Terminals

Electric Monorail Hoists and Traveling Cranes Installed on Steamship Piers by Shepard Electric Crane and Hoist Company

ONE of the greatest difficulties in equipping existing terminals and freight houses with modern freight handling equipment is the fact that the overhead construction of the piers is not heavy enough to support the weights of a type of monorail hoist which is rugged enough to stand up under the hard work called for in this type of service. Another difficulty is that usually these buildings are comparatively low and there is not sufficient room for the installation of this type of apparatus.

It is strongly urged that in considering the extension of existing buildings the matter of handling the equipment be given serious thought and the manufacturers of hoisting equipment be given an opportunity to demonstrate the savings possible by the use of efficient freight handling equipment. The Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., has made comparatively few extensive installations of such machinery in strictly marine terminals, but the company has had a great deal of experience in solving the freight handling problems of many of the industrial plants where the conditions to be met are fully as difficult to solve as in a marine terminal.

Floor-Operated Monorail Hoist

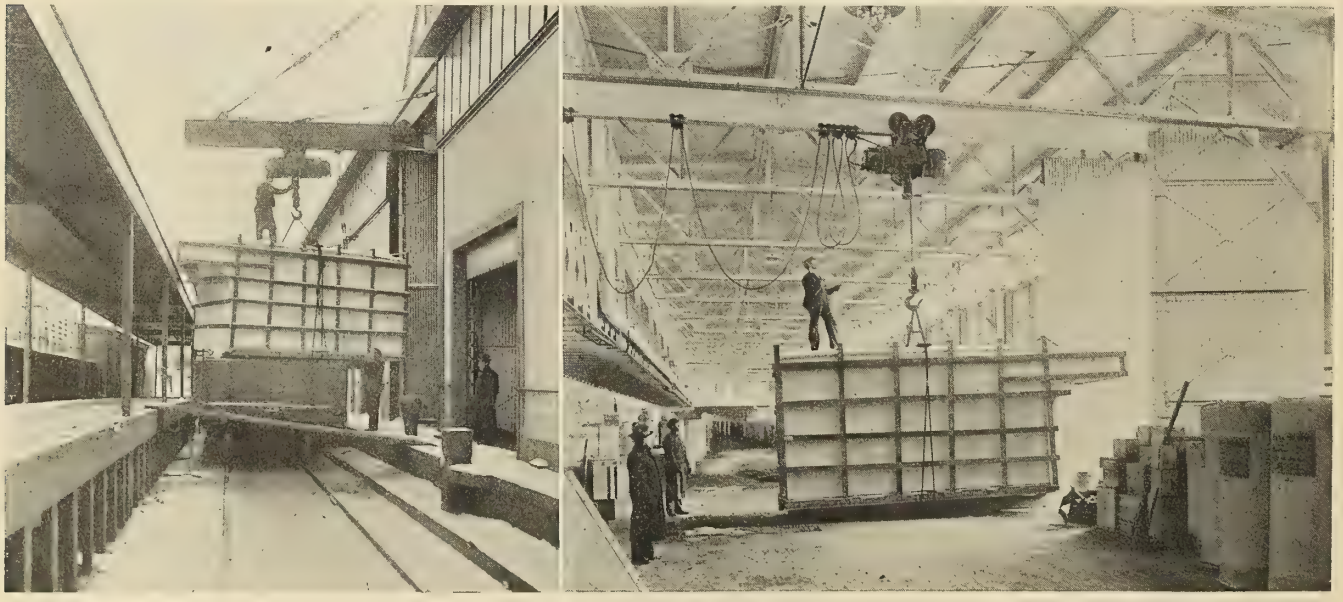
At one of the terminals of the Central Railroad of New Jersey, for instance, freight is brought to the pier by lighters and unloaded by a 10-ton floor-operated monorail electric hoist installed by the Shepard Electric Crane & Hoist Company, as shown in Figs. 1 and 2. The miscellaneous package freight is deposited from the lighter onto the deck of the pier and then trucked to storage space, whence it is loaded onto wagons for delivery about the city. The heavier articles are deposited directly on trucks from the hoist.

Fig. 3 shows three 2-motor floor-operated monorail electric hoists each of 3 tons capacity mounted on the upper deck of pier No. 6 of the Bush Terminal, Brooklyn, N. Y. These machines handle freight which is delivered to the pier directly from steamships. The material is brought beneath the hoist runway by electric trucks hauling a string of trailers, each trailer having a removable platform upon which the freight is piled. The electric truck leaves the trailers directly beneath the hoist runway and returns down the pier for another load. During the time when the truck is going after a second load the hoist operators remove from each trailer the platform upon which the freight is loaded. These platforms are lowered through the hatchway, as shown in the illustration, and deposited on automobile trucks, which run in on the main deck of the pier for distributing the freight to warehouses and other destinations.

Cage-Operated Monorail Hoist

At the plant of the J. Edward Ogden Company, Bayonne, N. J., a 2-ton capacity cage-operated monorail electric hoist, installed by the Shepard Company, handles material directly from the barges. As can be seen from Fig. 4, the material is picked up after it has been deposited on the end of the pier and then carried directly to the storehouse shown in the background. Cage-operated monorail hoists of the type installed here are especially recommended for freight handling. The machines are equipped with powerful motors, giving high speed both in the hoisting and traveling motions. When handled in conjunction with switches or transfer bridges this type of machine, it is claimed, insures the most economical handling of freight possible.

Another type of heavy equipment for handling bulk freight is shown in Figs. 5 and 6. This installation comprises six 3-trolley cage-controlled overhead electric traveling cranes, two transfer scale cranes and two floor-operated monorail hoists. This equipment was installed several years ago at the plant of the St. Lawrence Sugar Refining Company at Montreal, Canada. The plant is



Figs. 1 and 2.—Ten-Ton Floor-Operated Monorail Hoist Installed at Pier of Central Railroad of New Jersey

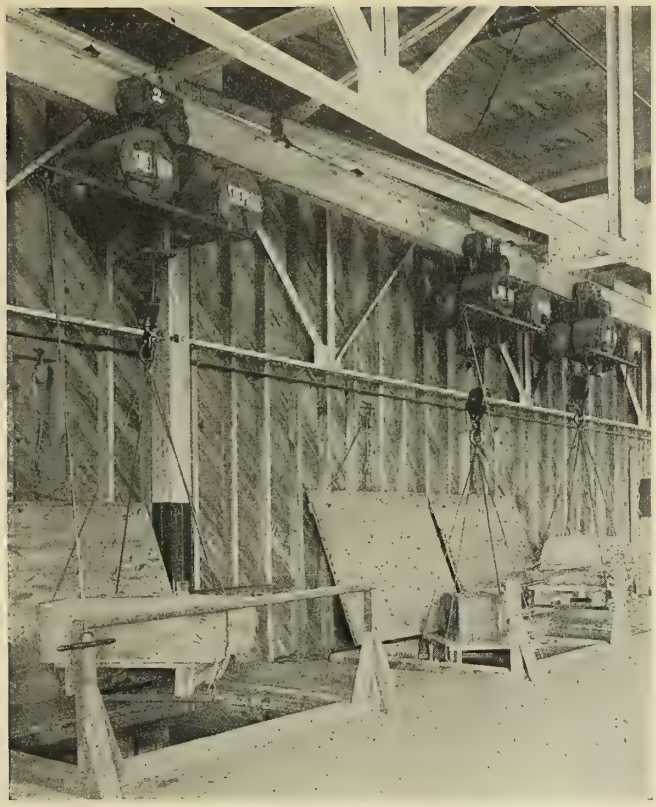


Fig. 3.—Two-Motor Electric Hoists at Bush Terminal Pier

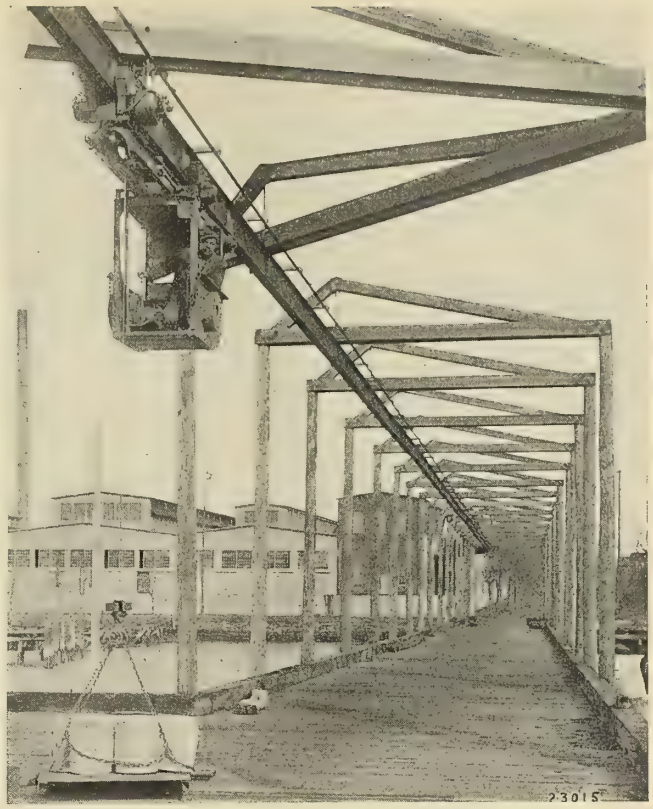
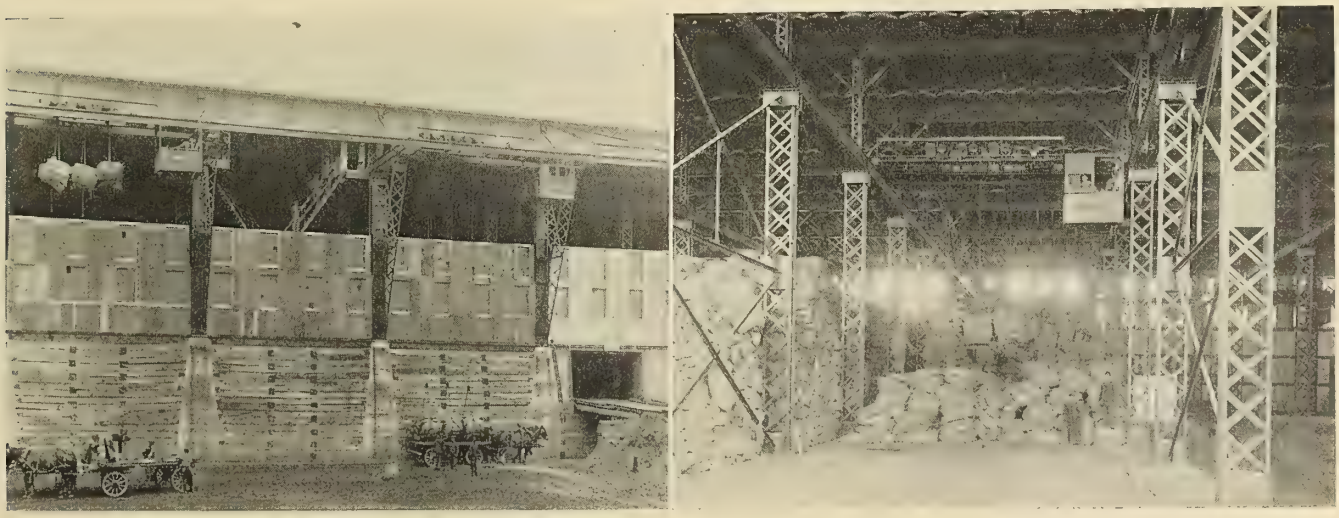


Fig. 4.—Two-ton Cage-Operated Monorail Hoist

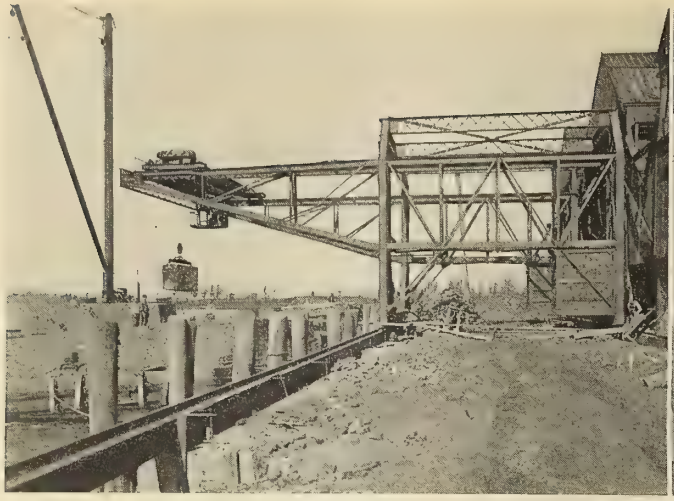
located on tide water, the bagged sugar being unloaded from ships directly onto trucks, as shown in Fig. 5. The bags are loaded on slings placed on the truck body, so that the overhead cranes can lower their hooks directly on to the pier, thus lifting an entire wagon load of sugar at one time. After the loads have been raised sufficiently to go into the opening under the crane runway, the crane is run into the building a few feet, where it runs on to the scale crane and, while the weighing process is under way, this scale crane is driven along the end of the building until it reaches the bay into which it is desired to deposit the bags of sugar. Fig. 6 clearly illustrates the method of unloading. This installation has been found very successful in operation, the handling cost having been reduced very greatly over the hand trucking method employed before the installation of the traveling cranes.

Figs. 7 and 8 illustrate the method employed by the Richmond Brick Company, Green Ridge, Staten Island, N. Y., in loading and unloading brick from barges. It will be seen by Fig. 7 that a gantry type structure is employed to enable the overhead traveling crane to run out over the barges. When it is desired to remove a barge load of brick from one of the storage buildings, the gantry is moved along its runway until the crane rails mounted on top of the gantry come in correct alinement with the crane rails of the building. When this is accomplished, the overhead traveling crane runs out on to the gantry and lowers a load of 5 tons of brick on to the barge, and repeats the process until the barge is fully loaded. When it is desired to unload the barge of bricks the process is of course reversed.

The particularly interesting feature of this installation



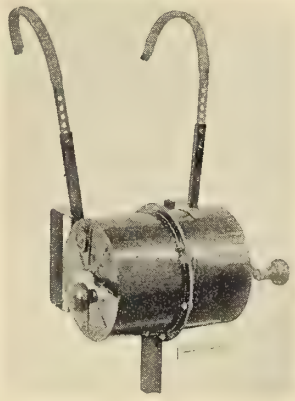
Figs. 5 and 6.—Hoisting Equipment at Tidewater Plant of St. Lawrence Sugar Refining Company, Montreal, Can.



Figs. 7 and 8.—Equipment Used by Richmond Brick Company, Staten Island, N. Y., for Handling Brick

is the application of the gantry structure for transferring the traveling crane from one building to another. If this idea had not been developed, it would have been necessary to install an overhead traveling crane in each of the buildings, with a structure built out over the pier so that each crane might run out far enough to bring its load directly over the barrge.

The design of the Shepard apparatus is well adapted to the service required in marine terminal work, where unskilled labor is largely employed, as the cranes and hoists are as nearly fool-proof as it is possible to make this type of machinery. The design is such that standard units may be combined so as to meet the requirements of almost any special installation with standard apparatus.



Portable Controller

How Electricity is Harnessed to Terminal Work

Moving Freight by Electricity—Source of the Power—Generators, Transformers, Motors and Control Appliances—Methods of Braking—Storage Battery Trucks

BY ROBERT H. ROGERS *

ELECTRICITY has become almost the universal power for operating freight-handling machinery for both bulk and package freight—the only serious competitor being steam in some branches of bulk cargo handling machinery. The art of moving freight by machinery has advanced rapidly and the developments are as varied and numerous as this complicated and extensive work would indicate. Between ambitious electrical energy on the one hand and the great variety of work to be accomplished on the other, there is interposed an ingenious array of apparatus, devices and systems for the safe and sure harnessing of the power to the work.

Energy may be purchased from a large public service company or generated at or near the place of using by means of steam turbine generators, gas or oil engine driven generators or the like. The central station power is to be preferred principally on account of continuity of service; it is ready at any hour of day or night and breakdowns are almost an impossibility, due to resources in the way of spare machines, excess power and alternative circuits. At one of the greatest terminals on the American coast the accumulated shutdown for lack of power in four years was seven and a half minutes. The central station furnishing this power has certain major circuits which have not had a shutdown in twelve years.

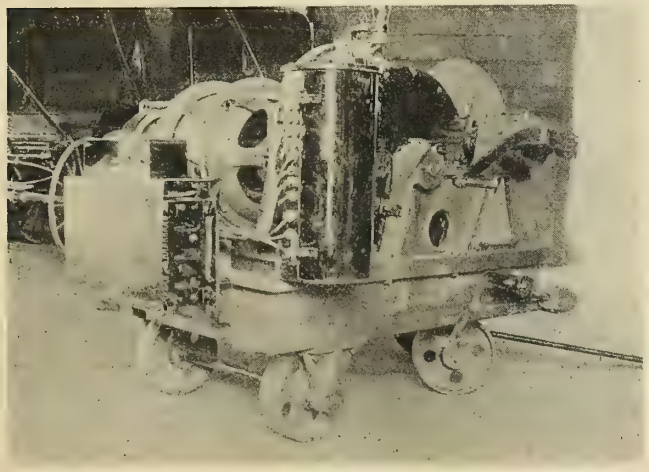
When all things are considered, the cost of central power will almost always have the advantage and unless there are peculiar local conditions or some special consideration the purchased power is best, especially when all-night lighting is considered. The power available may be alternating current delivered at from 550 to 13,200 volts (with 2,300 volts probably the most common) or

* Power and Mining Engineering Department, General Electric Company, Schenectady, N. Y.

Some Classes of Terminal Work Require the Interposition of a Storage Battery

direct current at from 230 to 600 volts. The alternating current has an additional characteristic in the number of reversals per second or cycles as it is called. This may be 25, 40 or 60 cycles, with an occasional region having 50 cycles. Again the alternating current may be made up of one, two or three strands, as it were, called phases, known as single phase, two phase or three phase. Direct current varies only in the voltage.

For safety it is not advisable to use the high alternating current voltages directly at the machines, and in some cases it is desirable to use direct current at the machines when only alternating is available, hence recourse is had to transformers and converters or motor-generator sets. The transformers step down the voltage to a convenient and safe value, while the converter or motor-generator changes the energy from alternating to direct, as desired. Direct current is usually used as delivered, except when low voltage is required for charging batteries, in which case a motor-generator set motors off the high voltage and generates the lower voltage required. When only a small quantity of direct current is required at low voltage, recourse may be had to a rectifier which changes alternating to direct current through the check valve action of an electric arc through mercury vapor.



Typical Dock Hoist, Showing Motor, Controller, Starting Resistance and Solenoid Brake

The motors used on alternating current lines are usually adapted to the phase and cycles available, though in some cases it is desirable to change from two to three phase, which is done by specially connected transformers. As a general thing the highest safe voltage is selected in order to keep down the cost of standing circuits as high voltage means low current and small wire for a given horsepower transmitted.

In order properly to safeguard the system, to measure the energy used and to distribute it conveniently, the public service cables (if direct current) are brought to a service station or panel which is enclosed in a cabinet and on which are mounted switches for manually opening the circuit, automatic circuit breakers for opening the circuit when an abnormal overload occurs—safety valves, in fact—and a meter for measuring the energy used. From here cables lead to a distributing panel, where a network of bus bars and switches break the main line up into lesser circuits leading to the various piers, warehouses, large machines, battery charging station, etc. Here the lighting circuits may be separated from the power circuits and separate meters installed to indicate lighting load, which usually takes a different rate. Following a circuit now to a specific pier, we will find another distributing panel which again subdivides the lines to various parts of the pier, as to elevators, to wall receptacles (for portable machinery), to the principal hoists or cranes, etc. If the

lighting circuit is taken off here it will be subdiveded into pier working lights, watchman's lights and office lights, and another circuit to receptacles where ships may attach hatch clusters.

In the case of an alternating current supply there will be interposed between the panels as above described and the public service lines a transformer house or substation containing the necessary transforming or converting apparatus for rendering the energy suitable for the purpose. Where large machines are installed which require a considerable amount of power, high voltage circuits may be taken to points near them where transformers are installed to reduce to a working voltage, thereby saving some cost in the copper necessary to get the energy to the machine.

Selection of Motors

With electrical energy available at the machine, we now turn to the motor which changes it to mechanical energy to perform the hard drudgery of freight handling which formerly wore out good men, cost more money and took more time and space. Motors are selected to meet the peculiar requirements of each type of machine and to operate on the energy that has been brought to their leads. The principal non-electrical characteristics of motors are:

(a) Speed, which, if high, makes a cheap, small motor, but requiring much gearing to get down to the speed required in the working parts of the machine driven. If low speed, the motor will be heavy and bulky and will cost less trouble, can be put close to the work to be done —i. e., having less gearing interposed, it works more efficiently.

(b) Mechanical strength. Proof against ordinary accident, mismanagement, weather and shocks. Some types need to be enclosed to a greater or less degree to attain this desirable feature, other precautions are highly specialized insulating materials, great security of internal fastenings and high factor of safety on all parts subject to strains.

(c) Starting and running characteristics. Some motors have very high starting power, others can pull but little until up to speed themselves; some motors hold their speed at any load, others rise and fall with every change in load, and some have a high flywheel characteristic which is undesirable if frequently started and stopped.

(d) Accessories. Among the common accessories are sliding bases and pulleys for belted motors, back geared shaft for slow speed gear drives, and enclosing covers of various types. An important adjunct in freight-handling machinery drives is the solenoid brake, a device which is held released while the motor is energized, but which instantly grips and stops the motor if the circuit is accidently or purposely broken. This device plays an important part in the manipulation of the motor and certain machines where a rapid cycle of operation prevails.

The above motor characteristics are only the most prominent ones, but these and the minor considerations make the selection of the proper motors a question not easy to answer, especially when insufficient data are known to cover all phases of the question.

The control systems and apparatus for motors leads into an intricate and ingenious field which has done more to intrench electric power securely than any other item. Electricity lends itself so readily to rapid and complicated manipulation that steam and hydraulic power are clumsy by comparison. Motors may be thrown "on the line" by a simple knife or snap switch, if their size and characteristics are such that they and the line can stand it. Larger motors require to be eased on by steps of some sort, as provided by starting rheostats, drum controllers or compensators, as the case may be. Now it is frequently desirable to vary a motor speed, and this is done on direct current machines by additional points on rheostat or drum controller by inserting resistance gradually in the field exciting circuit. Alternating current motors are not normally variable in this sense, but certain types can be varied by the insertion of resistances in the rotor circuit. Multi speed A. C. motors are available, however, and where the speeds are well chosen the control and operation are very satisfactory.

For very large motors, or where several motors have complicated related functions, the control may be magnetic—that is, the main circuits are opened and closed by magnetically operated contactors, which in turn are actuated by a minor circuit through the master manual controller. In a way the energy governs itself under the guidance of the master controller. This system has the added advantage of ease of manual operation, an important point where rapid cycles are carried out all day long. A further departure is the portable master controller which the operator carries about with him, the flexible cable giving him 100 feet radius of action if needed. This device allows the operator to stand where he can best see his work or to walk about following the loads, insuring the greatest safety and speed. By means of this portable controller signal men are dispensed with, and as two motors can be run by one operator a great labor saving follows.

The quick, safe and sure stopping of motions in freight-handling machinery is essential to fast work, just as modern fast trains are possible only because of highly developed brakes.

Method of Braking

There are several methods of braking in use, the most familiar being the foot or hand operated band brake. The solenoid brake, mounted so as to act directly on the motor shaft, is a very efficient stopping device, and has the additional element of being an automatic safety stop, for, should the current fail the brake acts and prevents further motion, such as overhauling by the load and the like

Dynamic braking makes use of the principle that a motor, if driven by an external force, becomes a generator and offers resistance to that force. The energy from the generator *pro tem.* is dissipated in a bank of resistance grids—i. e., they are heated and dispense the energy in that form. This allows of arranging a controller to give various degrees of braking as required, rather than all on or all off, as is the case with the solenoid brake. This method of braking does not wear out any bands, shoes or other surfaces and does not have to be adjusted to take up wear. However, a solenoid brake must be used to get a full stop. Another step in the braking art is regenerative braking, wherein the current generated by the reacting motor is of the proper voltage to allow of its being switched onto the main line, thus conserving energy, for this energy may now assist some other motor rather than to simply heating up some inert iron. This system is most highly developed in the electric locomotive, which in holding back a heavy train on a grade may turn as much as 2,100 kilowatts of useful energy back into the system to help the power house pull some other train up a grade.

In order to bring electricity to the work, it is necessary in some cases to break it off, as it were, to give the motors more freedom of motion. For such machines as industrial trucks (electric stevedores), portable cranes, electric tractors, commercial trucks, etc., storage batteries are used to furnish the energy which has been stored in them in the form of a chemical distortion which rights itself by de-

livering the required electricity when a circuit is formed.

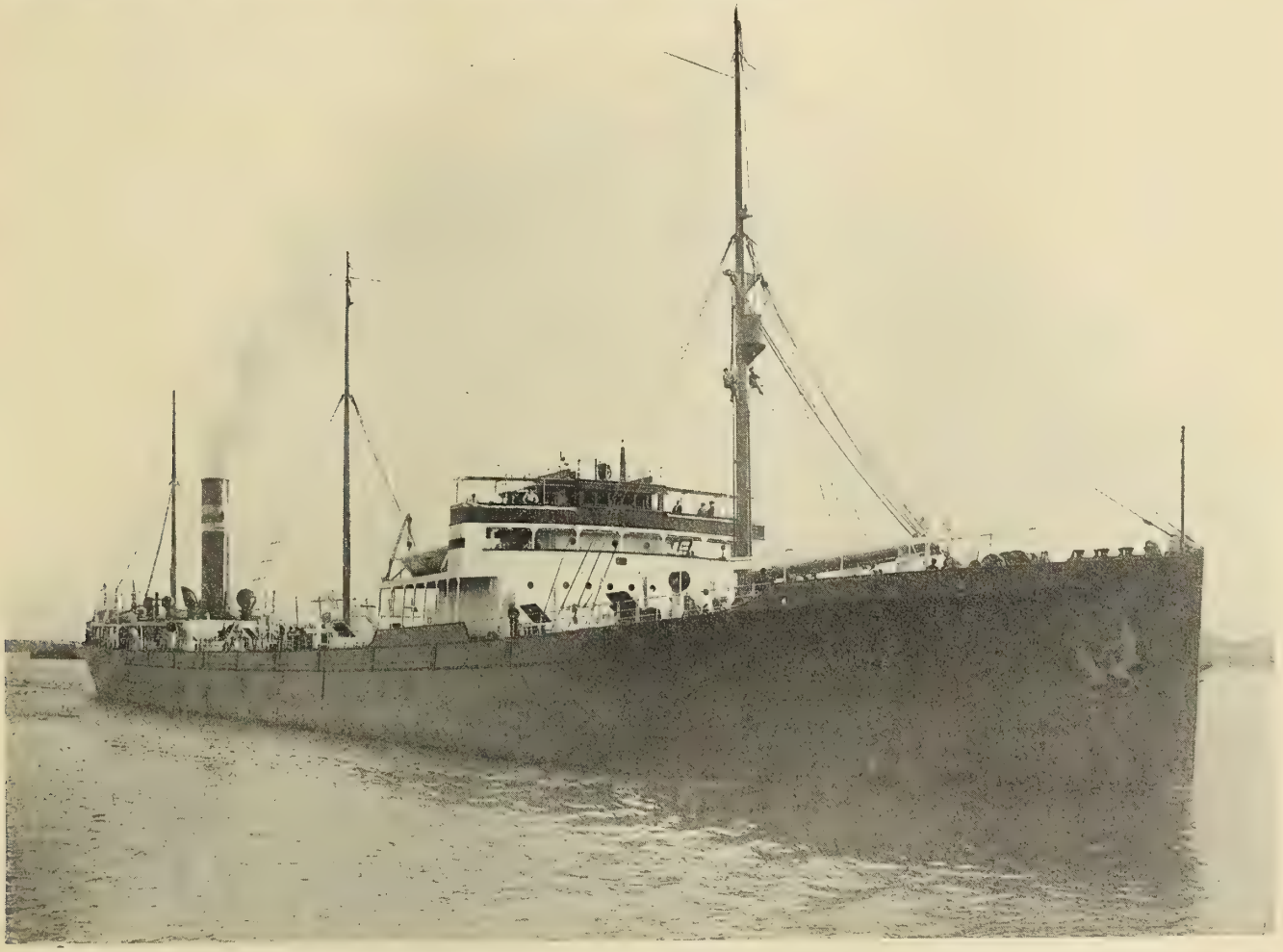
Storage batteries require about as many hours for charging as they can be used, and naturally take much more energy for charging than they can return. Two types are in common use—lead and Edison. The lead batteries are made up of metallic lead and litharge in a bath of diluted sulphuric acid, the whole contained in rubber or glass jars. The Edison battery is made up of iron and nickel in an alkali bath, the whole contained in steel cans. The general characteristics of the two types are similar, but differ widely in certain specific points.

Direct current must be had for charging storage batteries and at the correct voltage for the number and kind of cells to be charged. The proper care of batteries is essential both in charging and working them. Special motors have been designed to give the best results with the lowest possible drag on the batteries, which are, of course, limited in capacity at best. The control of such motors is simple, being confined to manually operated drum controllers. The braking is mechanical and not connected with the electrical system.

The proper lighting of terminals is coming in for engineering attention, and well it should, for where large numbers of men are engaged in handling heavy materials under pressure of modern traffic requirements, ample light well distributed is essential for safety of men and dispatch of freight. It would be hard to find equal area of equal activity so poorly and dangerously lighted as we find our terminals. In general, large numbers of units of small intensity are more desirable than few units of high candlepower. It is generally agreed that an illumination of .2 to .25 foot candles is the least that should be considered. Special lines, such as fruit and cotton, require special lighting for distinguishing grades or condition. Petty pilfering is much better discouraged by lights than by night watchmen, and as forty 150 candlepower lights can be operated on the wages of one night watchman, it is evident that the use of protective lights should be increased.

Terminal property, rolling and floating stock, and freight in transit are protected in large terminals and up-to-date piers by motor-driven fire pumps, specially designed and installed for operating under adverse conditions. The circuits and panels are so placed and protected that failure is practically impossible. Piping extends to all parts of the system with hose reels and sprinkler heads wherever needed.

There are so many variations in the energy available and so many kinds of work for the energy to do in terminals, piers and warehouses, that there is little wonder that so many kinds of motors, control systems, distributing apparatus and devices have been designed to tie them together. The proper selection of units to get safe, rapid and economical action on the part of the highly developed and complicated terminal machinery that now prevails, requires all the skill and technical training of engineers thoroughly familiar with the working conditions surrounding the handling and transfer of materials, and only the most hearty co-operation and interchange of ideas between the manufacturers of terminal machinery and the electrical engineers has made the modern terminal possible.



S. S. *Antwerpen*, Recently Built by the Newport News Shipbuilding & Dry Dock Company for the Rotterdam Petroleum Company, Reported Lost on Maiden Voyage. Length, 474 Feet 7 Inches; Beam, 60 Feet; Depth, 36 Feet 2 Inches; Deadweight Carrying Capacity, 11,500 Tons; Quadruple Expansion Engines, Scotch Boilers, Coal or Oil Fuel

Fig. 1.—Reinforced Concrete Ore Docks, Designed for Cleveland Furnace Company in 1906

Better Docks for Less Money

Reinforced Concrete Proves Ideal Material for Pier Construction—Comparison With Timber Structures

BY H. M. FARRAND *

BETTER docks for less money is rather a general term. Its value in meeting our present-day problem depends entirely on just how definite we can make this. Better docks mean well designed, efficiently laid out, permanent structures. Less money may, or may not, mean less first cost. It should be less total cost over a given number of years.

Of all traffic, of all burden carrying, water transportation costs the least. Docks, the points of contact between ship and land, have been, on the whole, rather expensive structures. Massive masonry abutment walls, requiring expensive foundation work, are high in first cost. Timber docks, open to rot and fire, are high in maintenance and low in service. Either type is expensive.

The Ideal Dock

Consider what an ideal dock should be: A loading floor with its outer margin adjacent to navigable water, sufficiently rigid to uphold any load placed on it, and able to withstand not only any impact shock from moving boats, but the outward thrust of banks, very often under heavy load.

The ideal dock should not obstruct the flow of the stream; it should not develop underscouring eddies and currents. It should be a dock, not a dam.

The ideal dock should be a permanent structure and its maintenance should be low. It should be rot, rust and fireproof. That dock is the ideal which gives you the maximum satisfactory dock service for the least total cost.

Necessity of Careful Design

The small amount of consideration that has been given to the careful design of permanent pier and wharf structures, when compared to the enormous amount of money invested in these structures, is surprising. Rule of thumb seems to have been the prevailing method employed heretofore, and it is only within recent years that owners have come to the conclusion that it is money wasted to build anything along this line without first securing the services of competent engineers who have had specialized experience and have made a study of this particular class of work.

Reinforced Concrete—The Ideal Material

Reinforced concrete is more than a material. It is an engineering force, making possible greater, more permanent achievement at less cost. Steel bridges, built to rust; wooden buildings, built to burn; timber docks, built to rot, are being replaced by concrete, built to last.

Consider now the ideal dock, and how reinforced concrete makes possible a better dock for less money.

Reinforced concrete develops strength without mass. With reinforced concrete an ideal dock, a rigid floor, carried out over the water and tied integrally with the shore

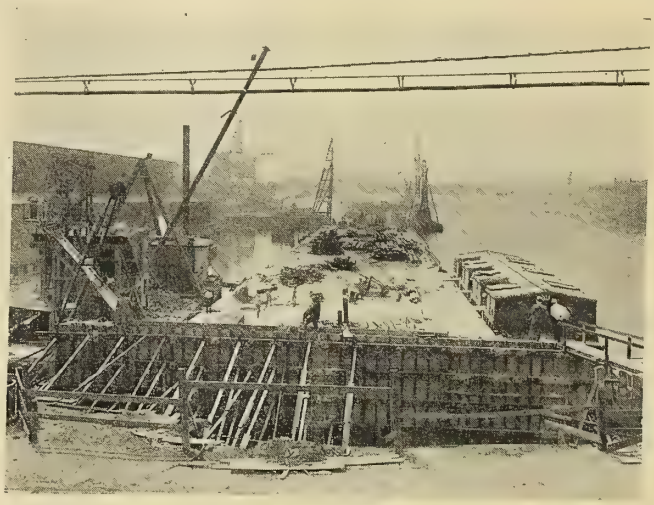


Fig. 2.—Concrete Coaling Pier Nearing Completion for the Pennsylvania R. R. at Canton, Md.

* Vice-President, Cleveland Dock Engineering Company, Cleveland, Ohio.

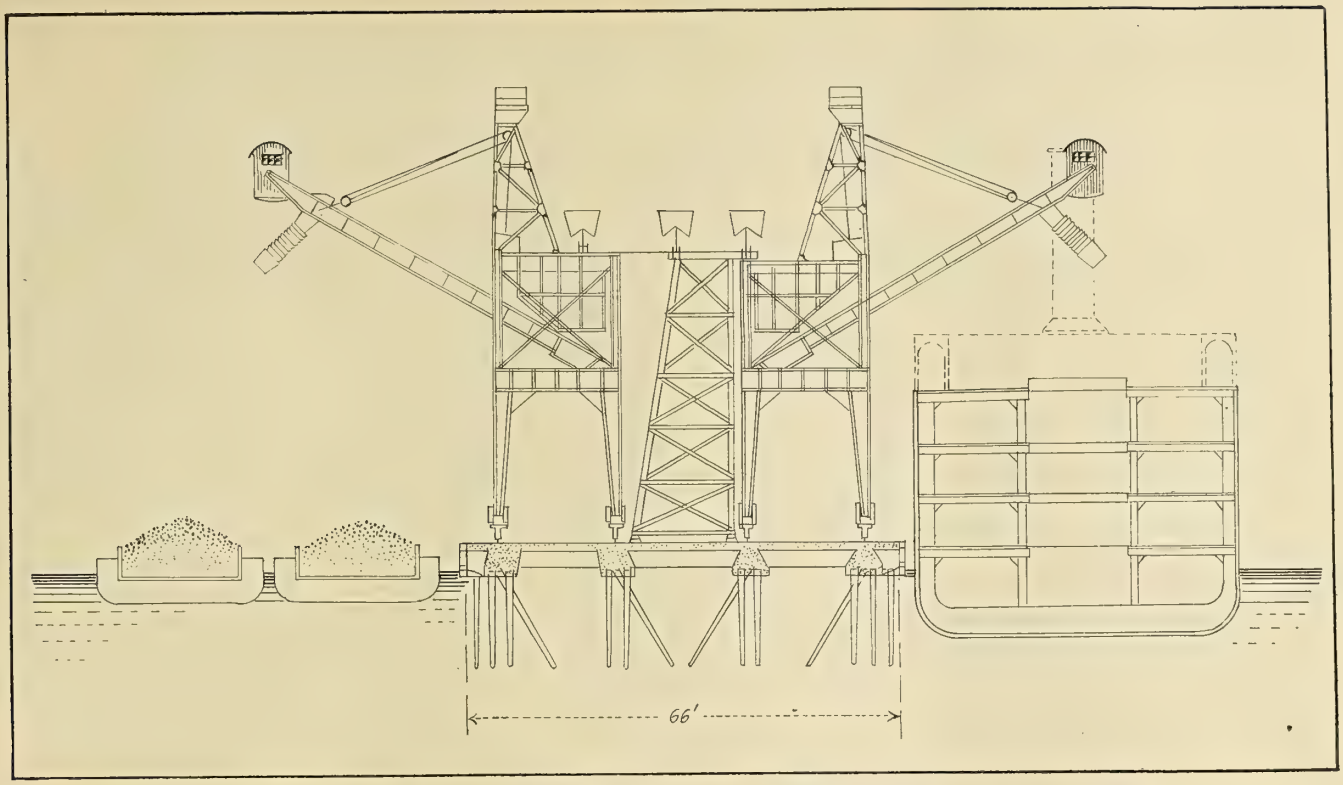


Fig. 3.—Cross Section of Coaling Pier with Capacity of 20,000 Tons Per Day at Canton, Md.

can be built, and built, too, at the least cost comparable with service value. A reinforced concrete dock can be built to withstand any practical impact shock and to carry any desired load. A modern reinforced concrete dock is a real dock—not a dam or a retaining wall. Well designed, it should not develop underscouring currents and eddies. A reinforced concrete dock is rot, rust and fireproof, and offers the maximum service value at a low first and a minimum upkeep cost.

Reinforced Concrete Not Expensive

The idea that a properly designed reinforced concrete pier or wharf structure is unduly expensive is wrong. The writer has in mind a pier that was designed for one of the larger eastern railroads in direct competition with the railroad's own engineers, who designed in timber. The result, according to the figures received from contractors, was astonishing. Not only was the figure submitted for the construction of the reinforced concrete structure lower than the figure for the timber design, but the saving was actually more than eight percent of the total cost of the work. A similar comparison was made recently near the heart of the long leaf yellow pine district. In this case the cost of the reinforced concrete structure was a trifle greater than the cost of a similar structure in timber. The difference was so small and the advantages of the more permanent type were so great that the timber design was not considered.

Life of Timber Piers

The life of timber piles below the perpetual saturation line is indefinite where there are no teredo or other "marine borers." Where marine borers exist an untreated timber pile will last anywhere from six months to five years. Treated piles (creosoted) will last from eight to twenty years. Only a short time ago the writer had occasion to examine some treated piling for one of the Southern railroads that had been driven about eight years ago and found plenty of evidence of teredo navalis.

The palmetto log, found in the South, resists the action of the "borer" to a considerable extent, although the best wood seemingly is the "greenheart" that is found in the northern part of South America. This wood is difficult to obtain and consequently very expensive.

Modern Concrete Structure

The use of the more permanent material in piers and wharves has changed the design to a considerable extent. The ore dock as designed for the Cleveland Furnace Company in 1906 (Fig. 1) has stood up successfully under extreme conditions and in the nine years that it has been in use it has cost nothing for repairs.

The combination ore floor and dock as designed for the Detroit Iron & Steel Company in 1908 is a different type entirely, making for strength as well as permanency. Only recently this dock successfully withstood a tremendous earth movement that completely wrecked adjoining concrete dock structures of a different design.

The progress photograph and cross section of a coaling pier (Figs. 2 and 3) now approaching completion at Canton (Baltimore), Maryland, gives a very clear idea of the methods followed in the design of structures of that class. The pier extends 942 feet into the water of the Patapsco River, which empties into Chesapeake Bay. Railroad coal cars are emptied into a storage bin by the usual form of elevating car dumper at the shore end of the pier; from the bins the coal is carried in small side dump cars that travel up an elevated structure on the pier and empty into movable hoppers which in turn deliver the coal by means of conveyors into the holds of the vessels. The plant has a capacity of 20,000 tons per day. The depth of water is sufficient for vessels drawing 35 feet.

In practically every type of engineering structure reinforced concrete has become the standard building material. Railroad bridges, culverts, dams, irrigation works, heavy building of all kinds—the question is no longer, Shall reinforced concrete be used? It is understood that reinforced concrete is the material and the only material to use. The day has now come when engineers who are responsible for marine structures, especially dock piers, are answering the age-long question in the same way.

Letters from Marine Engineers

Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Gasket Kink

The gasket of the cylinder head of a high pressure pump was very troublesome, in the matter of blowing out or leaking badly. A good deal of care was given to it each time it was renewed, even cutting the groove in the flange and top of the pump into which the packing was squeezed. This did not cure the trouble, nor would a copper gasket help us any.

An old-time oiler suggested to me that a piece of copper wire of about 3/32-inch thickness, annealed and laid in the groove with lapped ends, would cure us of our troubles. This was tried and found very successful, but anyone that tries the scheme should be very careful to see that the wire lays in the grooves that are cut in the flanges, or that you may cut, and that when setting up the nuts the opposite nuts are taken up on in rotation, this bringing equal strain on the flanges and preventing any chances of cracking.

This joint is ideal where there is call for a quick examination and replacing of any cylinder head, for there is no gasket to stick and require scraping off. It is also very cheap. C. H. W.

Direct and Indirect Valves

Replying to Mr. Kirvan's letter in the September issue, the use of the term "indirect valve" is only governed by good practice, and authorities agree that it has the meaning quoted in the August issue. If it were not for this fact, it would be entirely reasonable to interpret it as you suggest. The term is a poor one to convey the meaning. The following quotations may be of interest:

"The 'valve' having the live steam at the ends and the exhaust in the middle is called the *direct valve*. With the steam in the middle and the exhaust at the ends it is called indirect."—("The Steam Engine," by R. C. H. Heck, p. 186, ed. 1907.)

"The terms *direct* and *indirect* are often used synonymously with *outside* and *inside* admission. A *direct* valve is one having live steam at the two ends and exhaust between. * * * An *indirect* valve is one having exhaust steam at the two ends and live steam between."—("Valve Gears," by B. H. Fessenden, p. 63, ed. 1915.)

Annapolis, Md. Prof. H. A. Everett.

The letter on "Direct and Indirect Valves" on page 425 of the September issue interests me very much. I immediately referred back to the August number to see what had been stated in the answer to the inquiry in question.

I think Mr. Kirvan does not draw a fine enough distinction between the terms *direct and indirect valves* and *direct and indirect connected valves*. The question in the August number refers only to the valves; but it does not at all mention the manner of connection between the valve or valves, and the eccentrics which actuate them. The answer given is clear, to the point, and correct. It answers the question just as it was given, and it neither infers nor assumes anything else.

Mr. Kirvan is correct in his statements concerning the rockers which serve as a connection between the valve stem and the eccentric rod, but that is still true no matter what kind of a valve may be used. So it is quite possible to have direct and indirect valves, and direct and indirect connected valves, or a combination. But in speaking of any valve gear as a whole, it should be particularly specified as to the kind of valve and the kind of rocker, if there be any. This is necessary if one is to make a study of the gear with a view toward analysis.

I think it well to retain the qualifying words "direct" and "indirect" in relation to valves, as no other description that I know of is quite as suitable. Priority is also on the side of the use of these terms for both valves and gear. Charles J. Mason.

Scranton, Pa.

Helpful Suggestions for the Boiler Room

There are many handy kinks that any fellow can learn by a visit to the power plant of another ship and by being a subscriber to good engineering magazines. A few that I have adopted and some of my own origination may be found helpful in other plants.

The breaking of boiler water gage glasses is a frequent occurrence on most ships, due sometimes to vibration of the ship, change of temperature surrounding them (such as starting forced draft), carelessness in blowing them out in cleaning, or in setting up on them when they leak, without first shutting the valves, and a few other causes. We have posted on the bulletin board of each fireroom instructions about these causes and how to try and avoid some of them. This gives all hands a chance to learn, including coal passers, firemen and water tenders, and if engineers would write up some instructions on these subjects and post them for their men to read it will well repay them.

Now when a glass does break, the rapidity or saving of time in getting or putting in a new one is desirable, for even though we have try cocks, the sight of water in the glass is much pleasanter than the use of those. To aid in saving time I have constructed small lockers that are just large enough to hold four spare gage glasses, packing for them, wrenches to fit packing nuts and two packing hooks. One of these lockers is placed in each boiler room. They are painted white and on the door is painted in big letters "Spare gage glasses." The distinct advantage of these lockers is this: the glasses are there at all times for immediate use, and if you are steaming under forced draft and your firerooms are closed, they are handy and there is no time lost in going to the engineers' storeroom, through perhaps a half dozen air lock doors or watertight power doors, to get new ones.

Each of our water columns has a sheet iron guard fitted on one side of it, the side nearest the next glass or water column. This serves the triple purpose of acting as a guard against the water or steam from either glass, when

they break, striking the other glass and breaking it; as a reflector for the light on the water level (being painted white) and as an indicator for the proper height at which to carry the water level, this by painting a red stripe across the guard at the normal waterline. This red stripe is ¾ inch higher on the boilers furthest away from the boiler pumps, on account of the well-known fact that these boilers would be the first to experience trouble in losing water should the feed pumps start working poorly or slow down. All water tenders are instructed that their most important duty is to maintain their water as near that mark as possible, and when trouble is experienced to report it immediately to the engine room or pump room.

Device for Renewing Burned Out Grate Bar

When a grate bar burns out or drops out and you have a hot fire the work of getting a new one in its place in a short space of time can be accomplished if you make a

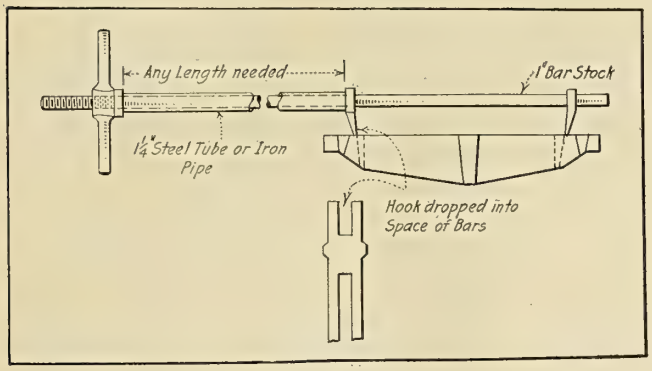


Fig. 1

simple bar clamp as shown in Fig. 1. Without the use of some device such as this the renewing of a bar has to be done with a hoe or slice bar, and we all know that it means the fire door has to be kept open too long, cooling the fires and boiler. This device is well appreciated when you have to put a bar in the back of a furnace. It can be made from lengths of old iron pipe and bar stock, which most ships have stored up somewhere.

Improvised Tube Cleaning Brushes

No doubt some engineers have had the experience of arriving in some port with dirty boiler tubes to be cleaned and found that all their tube brushes were used up. I experienced this, and the necessity was the mother of the following invention, not being able to purchase any in the port at which we were lying:

On all ships we can find plenty of old steel wire cable. Three-eighths inch diameter is the best for small tubes. Take a piece of ¾-inch hexagon stock and drill ⅜-inch holes. Start ½ inch from the end and drill them, one through each flat of the hex, just ⅜ inch from center to center. This, as shown in Fig. 2, gives you a spiral.

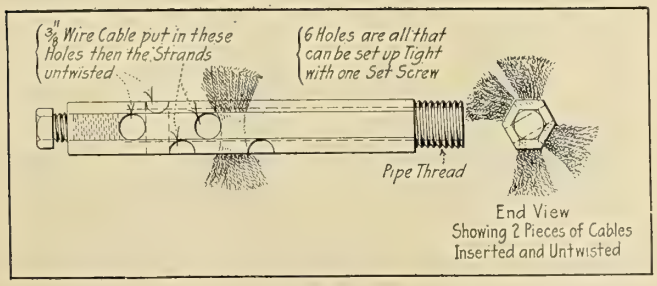

⅜" Wire Cable put in these Holes then the Strands untwisted
6 Holes are all that can be set up Tight with one Set Screw
Pipe Thread
End View Showing 2 Pieces of Cables Inserted and Untwisted

Fig. 2

Drill a hole 7/16 inch through the length and at one end tap it out for a ½-inch or 9/16 inch set screw. The other end turn down and thread for screwing into a ½-inch pipe. Now through the holes of the flats put pieces of cable and set up the set screw at the end, then with a pair of pliers untwist the strands of the cable and you have a fairly good cleaning brush. The lengths of the pieces of cable will depend on the size of the tubes to be cleaned.

C. H. W.

A Practical Discussion of the Effects of Combustion Space Upon Boiler Efficiency

A perusal of boiler history brings out one fact that most practical engineers of to-day seem to have overlooked. This fact is: no radical change in combustion space design. The structural changes, both in material and in placing of parts, have been numerous; nearly every engineer feels himself delinquent until he has in some way changed the baffling, the method of bricking or the arrangement of the internal feed pipes. Undoubtedly these are often of much value and lead to desirable results; but, as stated before, there is a lack of radical changes; the kind of changes that always mark a period of advancement in engineering. And the problem is up to the practical engineer, the man who is in close touch with all the good and bad points of his own special boiler, and he who can make first-hand observations under practical, every day working conditions, as governed by the many and ever-changing circumstances that fall to the lot of the practical engineer. The chemists have solved the problem of combustion and to-day the theory and the requisites of perfect combustion are available to all who put themselves to the trouble of going to the nearest library. The problem of obtaining the necessary requirements for perfect combustion is beyond the scope of chemists; it is the problem that now faces the engineer.

Until of late years the term combustion space held very little significance to engineers, it was simply used to designate a specific section of the boiler, and even to-day there are many to whom it apparently has the same old meaning; a name that is used because every one calls "that space above the grates and surrounded by heating surface," combustion space. But some years ago, when the internal combustion engine began to encroach upon the boiler field, the boiler builders began to sit up and take notice. There was a serious proposition to compete with, and they immediately began to investigate wherein laid the seriousness. It was evidently in the new method of mechanical utilization of the energy developed by combustion. But in addition the internal combustion engine people were going into the process of combustion in great detail and were finding out astonishing facts regarding the combustion of gases and vapors, all more or less similar to the same gases that had to be burned in boilers. So at once the term combustion space began to assume its rightful position in boiler society and was given the recognition long deserved but long neglected. Be this as it may, it is still spasmodic and to-day you can pick up many boiler catalogues, and while you will see references to grate surface, heating surface, baffling, structural integrity, etc., there is no mention of volume of combustion space. This is a fact and in the words of a poet, ignorance is bliss, but it is h—— on coal consumption.

Some few engineers of the day have taken up the matter of combustion space and their work has not only

been of great value, but it has fully paid them for their trouble and time and it is to be regretted that they have not had further opportunities to go on with their work.

The boiler of to-day must be considered as consisting of two fundamental parts: (a) a heat generator; (b) a heat absorber. The first must, for the purposes of analysis, be divided into two parts: (a) a fuel gasifier; (b) a gas burner. So we can consider three operations: (1) gasification of the fuel; (2) burning of the gases; (3) absorption of the heat liberated. Conceding that these three operations are essential to a boiler, it stands to reason that as the efficiency of each operation varies, so will the boiler efficiency vary, as the latter is the product of the former. The operations named above are carried out respectively: (1) on the grate; (2) in the combustion space; (3) by the heating surface. Experiments have demonstrated conclusively that the efficiency of all boilers varies with the rate of combustion, falling off at maximum rates. Furthermore, that this decrease in overall efficiency is due to loss in furnace efficiency, a straight line law being applicable to heat absorption. Hence the logical conclusion is that there is something wrong with the heat generating ability of the boiler; and as the average boiler of to-day receives the greater amount of its heat by convection, and with the same boiler grate conditions being similar, it is quite apparent that the fault can be traced to the combustion space conditions. A brief consideration of conditions will lead to the same conclusion.

The combustion of coal in a furnace is a chemical process in which oxygen reacts with the carbon and the various combinations of carbon and hydrogen. Consider the grate covered with a layer of fuel; heating takes place and the volatile of the fuel begins to distill and rise into the combustion space. If the rate of heating is slow the total combustible matter driven off as volatile is small and gaseous in composition; if the rate of heating is rapid the amount of volatile is large and contains much tar vapor. The former burns rapidly, the latter burns slowly. In short, with any given grate surface, there can be generated varying amounts of volatile, this volatile varying in combustion and requiring more or less time to burn, as the case may be. Therefore it is quite safe to say that if the combustion space is of proper volume for the one case it is most certainly not correct for the other case. Or to put it generally, combustion space must be the result of something and not something that results. Combustion space must bear a definite relation to the rate of combustion, otherwise maximum efficiency cannot be attained.

Type.	G.S. Sq. Ft.	Combustion Space Ft.³	Combustion Space With Fire 1′ Thick.	Ratio Column 2 and 3.	Ratio Column 2 and 4.	Rate of Combustion Lbs. Coal per Sq. Ft. G. S.	Seconds each Cubic Foot Stays in Combustion Space.
Normand (*a*)..	58.6	136	78	2.34	1.33	40	.077
Locomotive (*a*)	30	160	130	5.34	4.33	60	.17
Heine (*a*).....	35	250	215	7.14	6.14	25	.58
B & W (*b*)....	87.4	318	230.6	3.64	2.64	42	.15
B & W (*b*)....	87.4	318	230.6	3.64	2.64	13	.49

(*a*) Bureau of Mines Bulletin No. 23.
(*b*) Writer's Notes.

A consideration of the above shows that there is a wide variation in the ratio of combustion space to grate surface; also that the time allowed for the combustion of the volatile in the combustion space is small. Any chemical action that takes place in this time must be in the nature of an explosion. It will also be noticed that as the thickness of the fire bed increases, the combustion space decreases; likewise the period allowed for combustion, so that at high rates of combustion, great volumes of black smoke may not always be caused by improper firing, but caused by something beyond the fireman's control.

To consider a special case, take the B. & W. boiler, listed in the table above. The table shows that at the maximum rate of combustion, the time allowed for combustion of the volatile in the combustion space is about .2 of a second, increasing to .5 of a second at ordinary rates. Furthermore, as the rate of combustion increases the volume of combustion space decreases, due to the thickness of the fire bed, a necessary evil. In this case, a bed one foot thick reduces the original combustion space by eighty-seven cubic feet or 27 percent. And with the increasing amount of volatile, such volatile being of the kind that burns slowly, not a decrease of combustion space is desired, but most positively an increase.

What the proper volume of combustion space for given conditions of fuel consumption is can only be determined for each type of boiler by experiment. For boilers that steam year in and year out at a fixed capacity, the solution of this problem will be of the greatest benefit; for other boilers, namely, those that steam at various capacities, an investigation will, in all probability, be of benefit, for it is firmly believed, in view of the above facts, that in the average boiler of to-day the combustion space is too small.

In case that anyone desires to figure out the above data for his own boilers, the following procedure was carried out as regards the B. & W. boiler:

A sectional view blue print was used. The combustion space was divided into triangles, taking care to use right triangles when possible, as the area of these triangles can be obtained with length of base and altitude known —area being equal to one-half the base times the altitude. In the other triangles the following rule was used for obtaining the area: from half the sum of the three sides subtract each side severally; multiply together the half sum and the three remainders, and extract the square root of the product. Having obtained the sectional area, by adding the areas of the triangles, multiply by the width of the furnace and the result is the cubical space. To obtain column four, subtract as many cubic feet as there are square feet of grate surface. Column seven can be obtained from data on hand.

To obtain column eight, proceed as follows: Each pound of fuel will generate about twenty pounds of gases and water vapor. The temperature of these gases can be assumed to be about twenty-five hundred degrees Fahrenheit; so we get the following: Pounds of coal per square foot of grate surface multiplied by twenty, divided by thirty-six hundred, equals pounds of gases liberated per second. This under standard conditions. To reduce to conditions of the furnace temperature: Pounds of gases liberated per second multiplied by twenty-nine hundred and sixty multiplied by twelve and thirty-eight hundredths divided by four hundred and sixty equals cubic feet of gas liberated per second in the combustion space. Now divide column four by this last and the result will be the answer in seconds. D.

Launch of the S.S. Paris.—The new French Liner *Paris*, of the Compagnie Generale Transatlantique, was launched at St. Nazaire, France, on September 12. The vessel is 760 feet long, 85 feet beam and 59 feet depth from main deck to keel. Her displacement will be about 37,000 tons and she will be driven by quadruple screws actuated by steam turbines.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

CONDUCTED BY H. A. EVERETT *

Analysis of Stresses

Q.—(1) In the portion of bracket marked *A* (Fig. 1) would there not be a bending moment in addition to the tensile stress? How would the stresses be analyzed in this case, to show the amount of greatest stress and also location?

(2) In the rectangular nozzle or pipe (Fig. 2), with 30 pounds pressure inside of pipe, the tensile stress on the stays would be found, I presume, by

$$\frac{24 \times 24 \times 30}{\text{area of stay}}$$

but the difficult part is in finding the stress on ½-inch steel plate 24 by

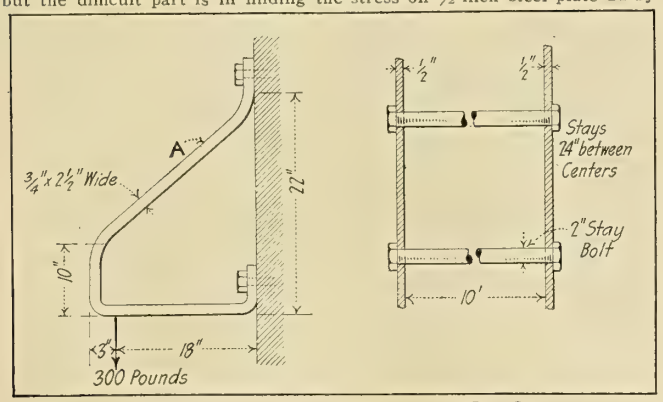


Fig. 1

Fig. 2

24 inches uniformly loaded with 30 pounds per square inch, supported at the four corners. How would this stress be figured?

(3) What books will aid me in solving these problems? DRAFTSMAN.

A.—The problems do not admit of exact solutions, but may be approximated. In the bracket problem, first consider the entire frame as consisting of the straight bar *CD* and the curved bar *AC* (Fig. 3). The reactions at *A* and *D* are as indicated, their *H* and *V* components being indicated separately. Taking moments about *A* we have

$$D_h\ (22) = 300\ (18)$$

$$D_h = \frac{300\ (18)}{22} = 245 \text{ pounds.}$$

Since the sum of the horizontal forces $= O$, $(\Sigma H = O)$ we have $A_h = D_h = 245$ pounds.

Isolating the part *CD* and replacing the forces acting on it by *H* and *V* components, we have the following figures:

Consider *CD* as a beam supported at the ends.

From $\Sigma H = O$ we have $C_h = D_h = 245$ pounds.

Taking moments about *C*, we have

$$21\ D_v = 300\ (3)$$

$$D_v = \frac{300}{7} = 42.8 \text{ pounds.}$$

$$C_v = 300 - D_v = 257.2 \text{ pounds} = A_v.$$

Now the direct stress in $CD = C_h = D_h = 245$ pounds compresion, and the maximum moment is over the load of 300 pounds and is $Dv\ (18) = 770$ inch pounds. The maximum compression due to bending

$$= \frac{My}{I} = \frac{770\ (3/8)}{.088} = 3{,}280 \text{ pounds per square inch.}$$

$$\text{Maximum total compression} = 3{,}280 + \frac{245}{1.875} = 3{,}410$$

Now consider the curved beam *A B C* (Fig. 5) with forces acting on it. In the portion *A B* the bending moment at any point $P = M = A_h y - A_v x$, but from similarity of triangles.

$$\frac{y}{x} = \frac{12}{21}, \text{ or } y = \frac{12x}{21} = \frac{4x}{7}.$$

Hence $M = x\left(\frac{4}{7}A_h - A_v\right)$

This increases with x and is a maximum at *B*, where $x = 21$. Its value at this point is

$$M = 21\left(\frac{4}{7}(245) - 257.2\right) = 2460\text{-inch pounds.}$$

The direct stress in *AB* is equal to the sum of the components of A_v and A_h in the direction of *AB*. This is found as follows:

Component of A_h in line of *AB*

$= A_h \cos \alpha$

$$= A_h\left(\frac{21}{\sqrt{585}}\right)$$

Component of A_v in line of $AB = A_v \cos \beta$.

$$= A_v\left(\frac{12}{\sqrt{585}}\right)$$

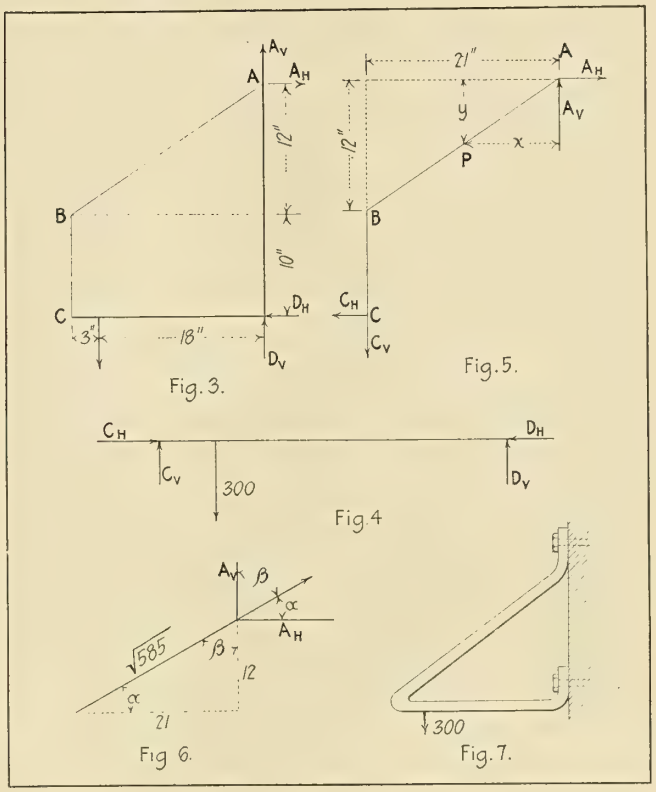


Fig. 3. Fig. 5. Fig. 4 Fig. 6. Fig. 7.

$$\text{Direct stress} = \text{sum} = \frac{1}{\sqrt{585}}(21A_h + 12A_v).$$

$$= \frac{1}{\sqrt{585}}[21\ (245) + 12\ (257.2)] = 341 \text{ pounds.}$$

Tension due to moment

$$= \frac{My}{I} = \frac{2460\ (3/8)}{.088} = 10{,}470 \text{ pounds per square inch.}$$

$$\text{Direct stress} = \frac{341}{1.875} = 182 \text{ pounds per square inch.}$$

Total maximum stress $= 10{,}470 + 182 = 10{,}652$ pounds per square inch.

The portion *BC* is under a direct stress $= Cv = 257.2$, and the maximum moment is at *B* and has the same value

* Professor of Marine Engineering, Post Graduate Department, United States Naval Academy, Annapolis, Md.

as found above. Hence the value found above (10,652 pounds per square inch) governs the design.

(2.) The equation for finding the stress in a flat plate supported at points in equidistant rectangular rows is givin in Peabody and Miller's "Boiler Design" as

$$f = \frac{2a^2}{9t^2} P,$$

in which a is the distance of points in a row, t is the thickness of the plate, P is the pressure in pounds per square inch, and f is the stress in pounds per square inch.

In this case

$$f = \frac{2\,(24)^2}{9\,(1/2)^2}\,(30)$$

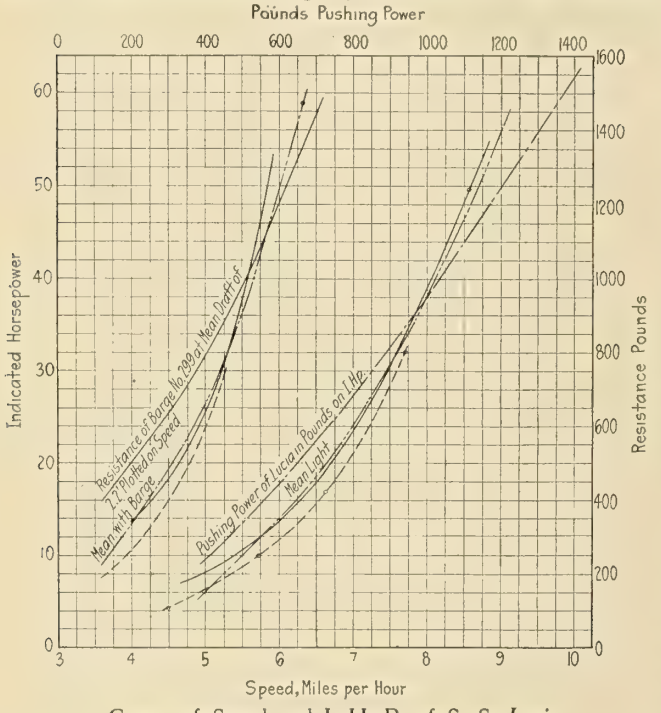
$$= \frac{34{,}560}{(9/4)} = \frac{4(34{,}560)}{9} = 15{,}460 \text{ pounds per square inch.}$$

(3.) Good books on stresses are Fuller and Johnston's "Applied Mechanics," volume 1, pages 1-66 inclusive; Hancock and Slocum's "Strength of Materials."

The bracket of problem (1) is a poor design, as the introduction of the curve in AC produces a large bending stress which would practically be eliminated by making AC straight. The form shown in Fig. 7 would be much better, and the bending stress in it could be neglected without material loss of accuracy.

Efficiency of Radial and Feathering Wheels

Q.—Our paddle-wheel steamer *Lucia* is a small river boat 60 feet by 16 feet by 20 inches draft. During the winter her wheel was changed from a radial wheel 9 feet diameter, 9 feet long, with 12 buckets 16 inches wide, 18 inches immersion, to a feathering wheel 8 feet 6 inches diameter, with 9 buckets 16 inches wide, and later to buckets 20 inches wide. As shown on enclosed diagram, the radial wheel within the limits of its speed proves to have the best efficiency. I do not know the eccentricity of the feathering wheel, but its mechanical operation is very good. From the report of the United States Towboat Board, from experiments by Prof. Sadler, of the University of Michigan, it is shown that a feathering wheel in nearly all cases is more efficient than a radial wheel. What is your opinion for the higher efficiency of this radial wheel?



Curves of Speed and I. H. P. of S. S. *Lucia*

Dotted curve, radial wheel; solid curve, feathering wheel, immersion 16 inches; dot and dash curve, feathering wheel, immersion 18 inches.

In your reply to a question in the July (1916) issue of MARINE ENGINEERING, pages 346-347, you make the statement that the constant C in the formula for wetted surface ($W.\ S. = C\sqrt{D} \times L$) should be 16 to 16.5. I take the liberty to state that I have worked out several calculations for wetted surface for our shallow-draft river boats, and find that C varies from 18.5—22, depending on the block coefficient. For a block coefficient of 78 C proves to be 20.7. The range of C from 18.5 to 22 covers block coefficients from 72 to 85 without much error. M.

A.—Efficiency is not always the best criterion on which to judge performance, as sometimes sufficiency is of more importance, if a certain amount of work has to be performed. The best published information as to paddle wheel action is contained in the report you mention, but it is essential that in selecting a wheel to do a certain work that it should be of such size that it can perform that work under conditions which are reasonable for its effective action. For example, *slip* is one of the prime variables in estimating both efficiency and power delivered by a propeller or paddle wheel, and it is perfectly possible to have a wheel of improper dimensions, say too large or too small, working at a slip widely removed from that for best efficiency but still performing the same resultant work that a wheel of better dimensions and working at a better slip would perform. The analysis of performance of a given wheel under different conditions, such as varying speeds or loads (which means at varying slip) can best be followed by noting the effect on *both* the curves of efficiency and thrust, and no complete conception of performance can be obtained without noting *both*.

Suppose in the light condition and running free, the slip is 20 percent, the effective thrust could be read from the curves of Fig. 1 made for this wheel. This is for a certain revolutions per minute, speed and indicated horsepower; now suppose the revolutions per minute are increased considerably, the speed would not increase quite so much, consequently the slip would increase and both the thrust and efficiency would change, one increasing, the other decreasing, and the indicated horsepower would increase. This same would be obtained by increasing the resistance by attaching a tow, the revolutions per minute being held the same.

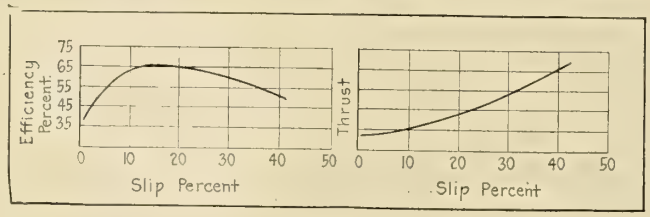


Fig. 1

Having seen the effect of varying the operating conditions of a given wheel, it is obvious that for any given service there is an infinite number of combinations of dimensions which will produce the result, but it is only those which give a unit that operates at the desired *slip* that will be most efficient. To refer again to Fig. 1, many of the towboats are designed to operate when loaded at a very high slip (60 to 70 percent), and the operation light is at a much less slip, higher speed and better efficiency. Apparently the feathering wheel has dimensions unsuited to the work it is called on to perform.

You have not imposed the condition of sufficiency into a comparison of efficiency, as the feathering wheel cannot do the work cut out for the radial. The revolutions per minute of each wheel are not given, and in absence of this information a definite statement cannot be made, but if the revolutions of the radial were lower than those of the feathering for the same speed, it would seem that a larger feathering wheel should be used, and conversely. In any case it is well to bear in mind the limitations of the original data, and it is very doubtful if the accuracy of this is such that conclusions from differences of 5 percent on power or less are tenable. Moreover, the speed determination is always a difficult one to obtain accurately, and it is interesting to note that an error in determining this, of from ⅛ to ¼ of a mile per hour, would entirely wipe out the difference in the two curves.

The information as to the values of the coefficient in Taylor's formula for wetted surface when applied to shallow draft vessels is very welcome and we are indebted to you for your kindness.

Shipbuilding and General Marine News

Contracts for New Ships—Marine Terminal Improvements—Recent Launchings—Improved Appliances—Personal Items

Steel merchant vessels building, or under contract to be built, in private American shipyards on September 1, according to builders' returns to the Bureau of Navigation, Department of Commerce, number 397 of 1,292,310 gross tons. It is expected that 332 of these vessels, aggregating 968,461 gross tons, will be launched during the current fiscal year, although the launching dates will, of course, be subject to the usual allowances for delays.

During August new contracts for 20 vessels of 75,060 gross tons were placed with American shipbuilders, and 12 vessels of 35,166 gross tons were completed. In the seven months from February 1 to September 1, American shipyards entered into contracts to build 229 steel vessels of 576,857 gross tons, and in this period completed 55 steel vessels of 206,545 gross tons.

Bids for a large portion of the first year's construction of the new naval building programme will be opened within a few weeks. Of the vessels authorized in this act, 66 of about 382,000 tons displacement must be begun as soon as practicable. As neither the New York nor Mare Island Navy Yards can undertake additional constructional work, and as a fuel ship will be built at the Boston Navy Yard, a hospital ship at the League Island Navy Yard, Philadelphia, and a gunboat at the Charleston, S. C., Navy Yard, practically all of the remaining vessels must be built in private yards.

It is significant that all deliveries of steel plates and shapes for shipbuilding recently contracted for will not be made until the third quarter of 1917, while practically all of the plate mill capacity for shipment during the first half of next year has been previously taken up aside from the options given on tonnage for this year's delivery and that held in reserve for Government work. The Carnegie Steel Company has already sent notices to customers who have placed orders for material for 1917, that in the event of the Government calling on the company for material for the naval construction programme, this demand will be given precedence to a reasonable extent in order to enable the Government to carry out its preparedness programme for the navy without unreasonable delay. Between the demands for steel and skilled labor that will be required for this extensive building programme, it is evident that new shipbuilding enterprises will have difficulty in competing for orders for anything like immediate delivery.

Shipbuilding Contracts

The naval bill just passed by Congress provides that work is to be begun during 1917 on four battleships, four battle cruisers, four scout cruisers, twenty destroyers, twenty submarines, one fuel ship, one ammunition ship and one hospital ship.

Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., has received an order to build two more steamers for W. R. Grace & Company, New York.

The Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md., has secured an order to build two more ships for Norwegian delivery.

The Willamette Iron & Steel Works and the Northwest Steel Company, Portland, Ore., will build three more ships for Lauritz Kolster, Stavenger, Norway. This makes a total of eight vessels recently contracted for by these two companies.

The Seattle Construction & Dry Dock Company, Seattle, Wash., has a contract with Norwegian interests for three 7,500-ton steel freight steamers to cost $2,650,000.

J. F. Duthie & Company, Seattle, Wash., have received a contract to build three 8,800-ton steel freight ships for Hannevig & Johnsen, New York.

The Alaska Steamship Company, Seattle, Wash., is planning the construction of three passenger boats to ply between Seattle and Alaska.

Kruse & Banks, Marshfield, Ore., have a contract from the C. A. Smith Lumber Company, Oakland, Cal., for the construction of a wooden vessel 260 feet long, to be equipped with steam turbines.

The Mathews Shipbuilding Company, Hoquiam, Wash., has received a contract from W. R. Grace & Company, New York, to build two wooden lumber-carrying vessels, to be equipped with internal combustion engines.

The Columbia Engineering Works, Portland, Ore., will build three auxiliary schooners for M. T. Snyder, New Orleans, La.

The Texas Company, Bath, Me., has $3,500,000 worth of work now under way, including four large steamships, two harbor steamers and one tug.

The Isthmian Canal Commission, Washington, D. C., will soon ask for bids for the construction of two 12,000-ton colliers to cost $1,500,000 each.

It is reported that Barbare Bros., Tacoma, Wash., will build several auxiliary schooners for A. O. Anderson & Company of Norway.

The United States Government has authorized the construction of a gunboat, 241 feet 2 inches long, 41 feet 2½ feet beam and 11 feet 4 inches draft, of about 1,575 tons displacement, to cost $600,000, at the Navy Yard at Charleston, S. C. Hitherto no craft larger than a tug has been built at the Charleston Navy Yard.

The Coastwise Shipbuilding Company, Baltimore, Md., has a contract from a Chilean firm for a vessel for the copper and coal trade along the west coast, to be equipped with semi-Diesel engines.

Bids were opened on September 5 by the Navy Department for 30 hydro-aeroplanes to be used by the Aviation School at Pensacola, Fla.

It is reported that plans are under way for the construction of four steel freighters of 5,000 tons each at the Grand Trunk Pacific Dry Dock Plant of Prince Rupert, British Columbia.

Fuel ship *No.* 12, U. S. S., will be built at the Navy Yard, Charlestown, Mass., at a cost of $1,500,000. The vessel will be 475 feet ong over all, 56 feet beam and 33 feet depth, with a displacement of 14,500 tons.

The Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md., has received a contract from Gustav Bull, Norway, for two cargo steamers, each of about 6,200 tons deadweight carrying capacity, to be built on the Isherwood system of framing and to be propelled by geared turbines.

It is reported that the Union Iron Works, San Francisco, Cal., are building two large cargo steamers on speculation, at their Alameda plant.

The Standard Shipbuilding Company, Shooters Island, N. Y. (New York City office, 44 Whitehall street), has received contracts to build three steel freight steamships, each to be 392 feet long.

J. F. Duthie & Company, Seattle, Wash., has received contracts from Norwegian interests to build three large steel freight steamships.

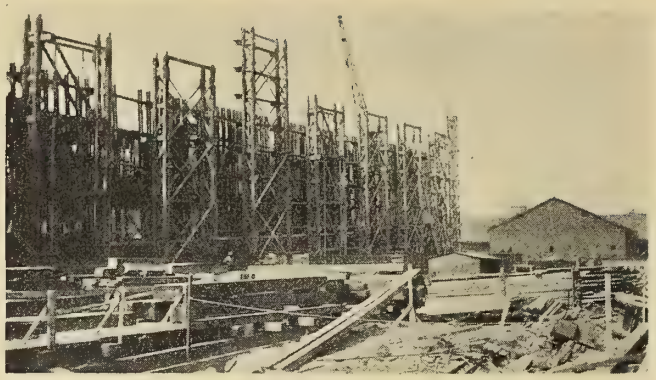
The Pennsylvania Shipbuilding Company, whose main office is Land Title building, Philadelphia, is reported to have received orders to build five ships and to have placed a contract for the necessary steel.

The Sun Shipbuilding Company, 1428 South Penn Square, Philadelphia, Pa., is reported to be about to begin work on four oil tank ships at its yard in Chester, Pa.

The Coastwise Shipbuilding Company, Baltimore, Md., will build several barges for the Reading Railroad Company, Philadelphia, Pa.

The Standifer-Clarkson Company, North Portland, Ore., will build a four-masted wooden schooner for Libby, McNeill & Libby.

Building Ships at Chester Shipbuilding Company's Yard



Tank Steamer in Frame at Chester Shipbuilding Plant

Shipyard News

The Standifer-Clarkson Company, Astoria, Ore., succeeds the McEachern-Standifer-Clarkson Ship Company. G. M. Standifer, Jesse Stearns and J. M. Robinson, all of Astoria, are the incorporators.

The Georgia Shipbuilding Company has been incorporated at Savannah, Ga., and will build a shipyard on Hutchinson Island. It is reported that the company already has on hand contracts for three wooden schooners and that it intends later to build steel steamers.

Hillyer, Spearing & Dunn, Jacksonville, Fla., are planning to establish a shipyard at Jacksonville. They report that they already have contracts to build four four-masted schooners, 200 feet long each. These vessels have been designed by Cox & Stevens, naval architects, New York.

The Peninsular Shipbuilding Company has been organized to establish a shipyard at Portland, Ore., for the construction of wooden vessels.

The Seattle Construction & Dry Dock Company, Seattle, Wash., which is now employing 1,750 men, will soon increase this number to 2,000.

Announcement was recently made of the intention to establish a fourth shipyard for building wooden vessels near Portland, Ore. William H. Curtis, naval architect, of Portland, will be manager.

The Tebo Yacht Basin, South Brooklyn, N. Y., has recently been acquired by the Todd Shipyards Corporation, New York, of which William H. Todd is president. In addition to this plant the Todd Shipyards Corporation now controls the Robins Dry Dock & Repair Company, Erie Basin, Brooklyn, N. Y.; Tietjen & Lang Dry Dock Company, Hoboken, N. J., and the Seattle Construction & Dry Dock Company, Seattle, Wash. The Tebo Yacht Basin will continue under the management of Theodore D. Wells, naval architect and marine engineer, of 32 Broadway, New York.

The R. L. Bean Shipyard, at Camden, Me., where the first of the world's six-masted schooners was built, now has contracts for three years' work.

The new shipbuilding plant of J. F. Duthie & Company, Seattle, Wash., will be laid out on a site covering 12 acres. Four building slips will be erected and equipped with an aerial cable system for handling material. Contracts have been placed for a 100-foot by 180-foot machine shop, a 208-foot by 80-foot mold loft, a pipe fitting shop, blacksmith's shop, carpenter and joiner shops and general store and office building. A floating dry dock of about 5,000 tons capacity, designed by William T. Donnelly, consulting engineer, New York, will be provided for handling repair work.

A 20,000-ton floating drydock with steel wings and wooden pontoons has been designed by William T. Donnelly, consulting engineer, New York, for the Sparrows Point shipyard of the Bethlehem Steel Company.

The shipbuilding plant of the Ellicott Machine Corporation, Baltimore, Md., has been leased to the Riter-Conley Manufacturing Company, Pittsburgh, Pa., a subsidiary of the McClintic-Marshall Construction Company. The plant has been leased for the purpose of building barges for carrying oil and general cargo, contracts for which have already been secured.

Norwegian Oil Steamer Malmanger Launched at Chester Yard

The launching of the Norwegian oil tank steamer *Malmanger,* on August 26, at the yards of the Chester Shipbuilding Company, Chester, Pa., is an event that should prove of considerable interest in marine and shipping circles, as typifying a revival of American shipbuilding activity.

Previous to the launching of the *Malmanger* there has been no activity in shipbuilding at this yard, which was at one time the John B. Roach yard, since the building of the *City of Savannah* for the Ocean Steamship Company in 1907.

Besides the *Malmanger* thirteen other ships are now under construction at the yards of the Chester Shipbuilding Company. All are to be equipped with propelling machinery, consisting of Westinghouse cross-compound turbines with double reduction gears and condensing equipment. The *Malmanger* is one of the newest type of oil tank steamers, and will have a capacity of 8,800 tons of oil in bulk. She is 401 feet long, 54 feet beam, 32 feet deep, with a draft of 26 feet, and will have a speed of ten and one-half knots .

Recent Launchings

The motor houseboat *Vagabondia,* designed by Cox & Stevens, naval architects, New York, for Mr. W. L. Mellon, Pittsburgh, Pa., was launched at the yards of the Gas Engine & Power Company and Chas. L. Seabury & Company, Morris Heights, New York, on September 14. The vessel is of wood, 130 feet long, 23 feet 6 inches beam and 3 feet draft, propelled by two 200-horsepower Winton engines, driving propellers arranged in tunnels. On account of its shallow draft the hull is strengthened by steel girders.

The oil tank motor ship *Ralph M. Bullowa,* one of four ships originally designed by Cox & Stevens, naval architects, New York, for the Transatlantic Motor Ship Company, Christiania, Norway, but recently sold to the Vacuum Oil Company, New York, was launched from the yards of the Baltimore Dry Docks & Shipbuilding Company, Baltimore, Md., on September 17. The vessel is built with Isherwood framing, and is 300 feet long over all, 47 feet beam and 28 feet molded depth. The oil tanks, thirteen in all, have a total capacity of 5,000 tons. The designed speed of the vessel at a load draft of 22 feet 8 inches is 10 knots.

S. S. *Malmanger* After Launching at Chester Shipyard

Motor Boat Fleet Passing Between Battleships *Maine* and *New Jersey* on Civilian Naval Practice Cruise.

The power boat *Privateer,* built by the Gas Engine & Power Company and Chas. L. Seabury & Company, Con., Morris Heights, New York, for Dock Commissioner R. A. C. Smith, of New York, was launched early in September. The vessel is 72 feet long, 11 feet 3 inches beam and 3 feet 3 inches draft, designed for a speed of 25 miles an hour.

The United States submarine *L-6* was launched on August 31 from the yards of the California Shipbuilding Company, Long Beach, Cal.

The oil tanker *Astral,* under construction for the Standard Oil Company of New York, was launched at the Union Iron Works, San Francisco, on August 29. The vessel is 457 feet long over all, 58 feet beam and 41 feet depth, with a capacity of 80,000 barrels of oil. Her speed is 11 knots, and she will be used in the Transpacific service to China.

The steam trawler *Whitecap,* the third of a fleet of five boats for the Bay State Fishing Company, Boston, Mass., was launched on August 28 by the Manitowoc Shipbuliding Company, Manitowoc, Wis.

The oil tank steamer *Sunoil* was launched by the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., on August 31, for the Sun Oil Company, Philadelphia. The vessel is of 11 knots speed and 10,000 tons deadweight carrying capacity, and will be used in the transatlantic trade.

The first of two steamships building by the Seattle Construction & Dry Dock Company, Seattle, Wash., for the New York & Cuba Mail Company (Ward Line), New York, was launched on September 20. A sister ship will be launched early in October.

The steamship *Paris,* of the Compagnie Générale Transatlantique, was launched at Saint Nazaire on September 12. The vessel is 639 feet long, 84 feet beam, of about 37,000 tons displacement. She will have accommodations for about 3,000 passengers.

The steamship *Edward Luckenbach,* the first of five steamers under construction by the Fore River Shipbuilding Corporation, Quincy, Mass., for the Luckenbach Line, New York, was launched on September 14. The vessel is 456 feet long over all, 57 feet beam, with a depth of 41 feet. Propulsion will be by a 4,000-shaft-horsepower Curtis turbine, driving a single propeller through reduction gears.

The four-masted schooner *Ada Tower,* of 528 registered tons, was launched from the Cochrane shipyard, Port Greville, N. S., on September 1.

Flagship *Sunbeam II* of Motor Boat Fleet on Civilian Naval Cruise

Pennsylvania Shipbuilding Company Lays Keel of Its First Vessel

The Pennsylvania Shipbuilding Company laid the keel of its first 7,000-ton oil tanker at its Gloucester, N. J., plant on Saturday, September 9, in the presence of the officers of the company, city officials, government marine inspectors and officials of other shipbuilding companies.

Although the work of constructing the new shipyard was started only six months ago and several of its buildings are still incomplete, work will be rushed on the first ship and, in the near future, keels of other ships intended for the merchant marine will be laid.

The company is building six 7,000-ton oil tankers and four 12,500 cargo boats. All will be equipped with steam turbines and reduction gears for a sea speed of 11 knots.

The main office of the company is in the Land Title Building, Philadelphia. The officers of the company are: H. E. Norbom, president; Charles H. Moyer, vice-president; Henry Lysholm, general manager, and George S. Hoell, secretary and treasurer.

Concrete Vessels, Designed by Norwegian Engineer, to be Build in America

The concrete lighter, which, according to the daily press, recently arrived at Christiana, was built by a company organized in Norway by Mr. Max Holzapfel, in order to exploit the patents of Mr. Fougner, a young Norwegian engineer.

We are informed that in all six lighters have been built at the shipbuilding yard in Moss, Norway, which has been acquired by the company, and that a contract has also been made for building floating docks on Mr. Fougner's patented method.

We are informed that Mr. Fougner is coming to New York the early part of next year, when he proposes to form a similar company for exploiting his patents in America in conjunction with his brother in New York and Mr. A. C. Holzapfel.

Elwell-Parker Electric Storage Battery Trucks

Elwell-Parker Tractor and Trailers at Steamship Pier

New Members and Managers of the American Bureau of Shipping Elected

At a meeting of the American Bureau of Shipping, held on August 22, the following additional members were elected to the Bureau:

UNITED STATES GOVERNMENT REPRESENTATIVES

Admiral D. W. Taylor, U. S. N., Naval Constructor, Chief of Bureau of Construction and Repair, Navy Department, Washington, D. C.

Rear-Admiral Robert S. Griffin, U. S. N., Engineer in Chief, Chief of Bureau of Steam Engineering, Navy Department, Washington, D C. E. C. Gillette, U. S. N., Naval Constructor, Navy Department, Washington, D. C. Geo. Uhler, U. S. Supervising Inspector-General, Steamboat Inspection Service, Washington, D. C. C. A. McAllister, Engineer in Chief, U. S. Coast Guard, Washington, D. C.

REPRESENTATIVES OF COMMERCIAL FIRMS

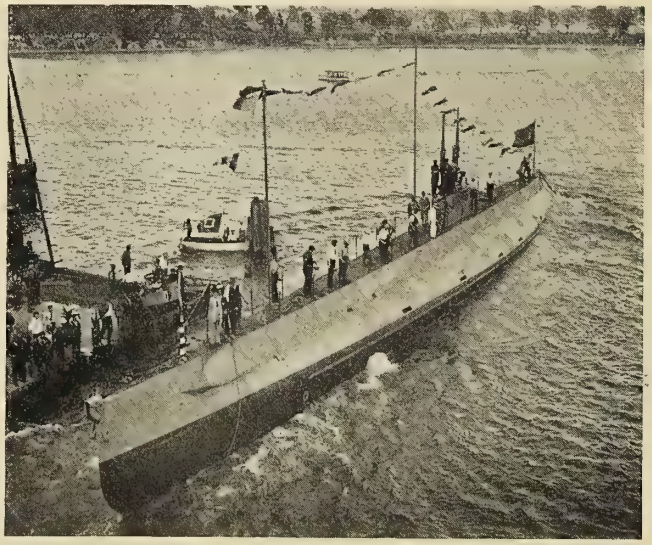
M. Bouvier, vice-president, W. R. Grace & Company, New York. J. G. Crowley, treasurer and general manager, Coastwise Transportation Company, Boston, Mass. W. J. Davidson, president, Staten Island Shipbuilding Company, New York. Geo. B. Drake, naval architect, Texas Company, New York. O. D. Duncan, Duncan & Mount, Proctors in Admiralty, New York. J. H. Gardner, vice-president, New England Steamship Company, New York. J. R. Gordon, traffic manager, Union Sulphur Company, New York. Harvey D. Goulder, Goulder, White & Garry, Proctors in Admiralty, Cleveland, Ohio. Robert M. Grant, president, New England Coal & Coke Company, Boston, Mass. Charles S. Haight, Haight, Sandford & Smith, Proctors in Admiralty, New York. H. W. Hand, vice-president, Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa. J. H. Jenkins, president, Merchants & Miners Transportation Company, Baltimore, Md. C. W. Jungen, manager, Southern Pacific Company, New York. E. F. Luckenbach, president, Luckenbach Steamship Company, New York. J. Lewis Luckenbach, vice-president, Luckenbach Steamship Company, New York. H. A. Magoun, vice-president, New York Shipbuilding Company, Camden, N. J. S. D. McComb, president, S. D. McComb & Company, Inc., New York. Wm. H. McGee, president, Wm. H. McGee & Company, New York. J. A. McGregor, president, Union Iron Works, San Francisco, Cal. F. D. Mooney, president, New York & Porto Rico Steamship Company, New York. Edgerton Parsons, Parsons & Company, New York. J. Howard Pew, president, Sun Shipbuilding Company, Philadelphia, Pa. W. H. Pleasants, president, Ocean Steamship Company of Savannah, New York. T. F. Rowland, Jr., president, Continental Iron Works, Brooklyn, N. Y. James Shewan, president, James Shewan & Sons, Brooklyn, N. Y. H. S. Snyder, vice-president, Bethlehem Steel Corporation, South Bethlehem, Pa. H. N. Townsend, director, Willcox Peck & Hughes, New York. H. B. Walker, president, Old Dominion Steamship Company, New York.

Additional managers of the Bureau were also elected, consisting of the following:

John S. Ashley, chairman, Great Lakes Protective Association, Cleveland, Ohio. W. G. Coxe, president, Harlan & Hollingsworth Corporation, Wilmington, Del. W. A. Dobson, naval architect, Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa. H. L. Ferguson, president, Newport News Shipbuilding & Dry Dock Company, Newport News, Va. H. S. Grove, president, Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa. Charles L. Hutchinson, Hutchinson & Company, Cleveland, Ohio. S. M. Knox, president, New York Shipbuilding Company, Camden, N. J. Wm. Livingstone, president, Lake Carriers' Association, Detroit, Mich. E. P. Morse, president, Morse Dry Dock & Repair Company, Brooklyn, N. Y. F. C. Munson, president, Munson Steamship Company, New York. J. W. Powell, president, Fore River Shipbuilding Corporation, Quincy, Mass. W. A. Prime, director, Willcox Peck & Hughes, New York. Chas. Skentelberry, marine superintendent, New England Coal & Coke Company, Boston, Mass. Wm. A. Thompson, Jr., vice-president, Texas Company, New York. Wm. H. Todd, president, Todd Shipyards Corporation, New York. H. A. Wheeler, vice-president, Union Trust Company, Chicago, Ill. F. W. Wood, president, Maryland Steel Company, Sparrows Point, Md.

At this meeting William H. Todd, president of the Todd Shipyard Corporation, New York, was elected third vice-president of the bureau, concluding the reorganization of the bureau. The personnel of the executive, classification and technical committees of the bureau will soon be announced.

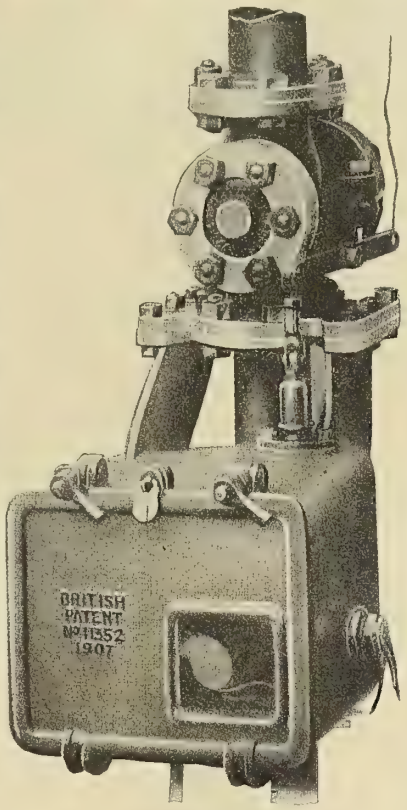
The management of the bureau has every reason to be encouraged by the general interest taken in the organization by shipbuilders, underwriters and shipowners, and it is confidently believed that in the next few years the bureau will achieve a very important and commanding position among the classification societies of the world by virtue of its efficient and valuable services to shipping and shipbuilding.



Submarine *Isaac Peral*, Built by the Fore River Corporation, Quincy, Mass., for the Spanish Government

The McNab Willett Bruce Steamship Whistle Control

In order that the steam whistle on any vessel may be as efficient as possible, it should be under absolute control, and installed in such a manner that no obstacle will make it inoperative, and so that the steam delivered to the whistle will be as dry as possible, insuring a clear, instantaneous signal. These results are obtained, it is claimed, by means of the Willett Bruce Steamship Whistle Control, manufactured by the McNab Company, Bridgeport, Conn.



Willett Bruce Whistle Control

The main operating valve admitting steam to the whistle is installed at the base of the whistle pipe adjoining the boiler casing. By this means the exposed part of the whistle pipe is kept free of steam, except when the whistles are in blast, thus reducing condensation to a minimum. Any steam condensed within the exposed whistle pipe during the working of the whistle falls by gravity, and is automatically drained off by a special automatic drain valve. The entire whistle pipe is therefore kept free from moisture, insuring a volume of dry steam to the whistle when the main valve is open, resulting in a clear, penetrating, crisp blast from the whistle under all conditions of weather.

The main steam valve is operated by a small pilot valve so that the energy required to open the main valve is reduced to a minimum and the blasts are instantaneous. The control of the whistle consists of electric and timing mechanism located in a control box placed immediately below the main operating valve. Both the time control and signal control are operated from the navigating bridge by means of special two-way switches. Three of these switches are installed with independent connection to the control box, so that the whistle may be operated from three positions on the bridge. An independent hand lanyard control is also provided to act as a stand-by in case of failure of electric power.

Motor Ship Sebastian Gives Satisfactory Service

On a recent voyage from Rouen, France, to New York, the motor ship *Sebastian*, of about 6,600 tons displacement and 4,100 tons cargo capacity, equipped with Werkspoor four-cycle Diesel engines of 1,650 brake horsepower, averaged a speed of 8.8 knots and consumed 6 tons of Solar fuel oil per 24-hour day on the voyage.

The *Sebastian* is a twin-screw vessel, 310 feet long, 45 feet beam and 26 feet 3 inches depth, built by the Caledonia Shipbuilding Company for Lane & McAndrew. When first built, the *Sebastian* was fitted with two 800 brake horsepower, two-cycle step-piston Diesel engines, built in Sweden, but owing to unsatisfactory service these engines were removed by the owners and replaced with the present four-cycle type Werkspoor Diesel engines.

One of the advantages of Diesel-engine drive in this vessel is shown by the fact that a total of 4,100 tons of cargo can be carried exclusive of fuel and stores on a displacement of only 6,600 tons, whereas with steam power the displacement of the boat to carry the same amount of cargo would have to be increased to from 7,000 to 7,500 tons.

MARINE ARTICLES IN THE ENGINEERING PRESS

The Present Position of the Marine Diesel Engine and Its Possibilities.—By Engineer-Lieutenant Commander W. P. Sillince, R. N. (retired). Abstract of paper read before the Institution of Naval Architects, April 13. General review of the development of the marine Diesel engine and forecast as to its future economical application to the propulsion of vessels of various classes. 6,000 words.—*The Engineer,* April 14.

Shipyard Cranes of the Rotterdam Dockyard Company.—By M. G. De Gelder. Abstract of paper read before the Institution of Naval Architects, April 13, describing all-around swinging type of cranes designed to run alongside the shipbuilding berths on top of lattice girders supported by columns. Capacity of cranes 3 tons at radius of 72 feet and 7½ tons at radius of 29 feet 6 inches. 3 illustrations. 3,250 words.—*Engineering,* May 5.

Spur Gearing.—By Daniel Adamson. Paper read before the Institution of Mechanical Engineers, London, May 19, 1916, discussing tooth shapes and proportions and materials for the construction of spur gearing, the allowable working stresses, maximum speeds and durability. 16 illustrations; 2 appendices. 8,250 words.—*Transactions of the Institution of Mechanical Engineers,* May.

The United States Lightships Nos. 101 and 102.—Abstract of a paper by Mr. George C. Cook read before the International Engineering Congress of 1915 in San Francisco, describing the general arrangement and construction of two lightships of 360 tons displacement, designed in the Division of Marine Engineering of the United States Bureau of Lighthouses. 8 illustrations. 1,200 words.—*The Shipbuilder,* July.

On Reduction Gears.—By John H. Macalpine. Serial article discussing the various actions and errors which affect the distribution of stress along the teeth and the proper action of mechanical reduction gears. Reasons for adopting the floating frame to attain the best possible results and explanation of how theory points to the beneficial action of the floating frame in greatly diminishing the most important defects with reduction gears. Data showing how experience has fully vindicated the leading of theory. Interpretation of "power constant," and discussion of various questions regarding the design of teeth. Discussion of marine installations, showing in several cases the additional saving in weight and steam economy which can be effected by the rise of the power constant made possible by the use of the floating frame. 12 illustrations. 26,000 words.—*Engineering,* May 5, 12, 19, 26, and June 2, 9 and 16.

PERSONAL

Alfred J. Brooks, for many years a draftsman at the old Roach shipyard, Chester, Pa., has been made superintendent of the Morse Shipbuilding Corporation, Noank, Conn.

Lieutenant James W. Lee, for many years associated with the Skinner Shipbuilding Company, Baltimore, Md. (now the Baltimore Dry Docks & Shipbuilding Company), has been appointed by the American Bureau of Shipping as surveyor for the ports of Norfolk and Newport News, with headquarters in Norfolk.

James V. Beekman, one of the founders of the Lidgerwood Manufacturing Company, New York, died at his home in Plainfield, N. J., in September 13, at the age of seventy-four.

Arthur T. Busch, formerly superintendent of the New Jersey Dry Dock Company, has been appointed manager of the shipyard of the Samuel T. Moore & Son Corporation, Elizabeth, N. J.

George C. Shepard, recently general manager of the Poole Engineering & Machine Company, Baltimore, Md., has opened an office in Baltimore as a consulting engineer for marine surveying and the design and superintendence of construction and alterations and repairs to vessels. In 1000 Mr. Shepard took charge of the engine design of the marine department of the Maryland Steel Company, Sparrows Point, Md., and in 1908 was made chief engineer of the marine department of this company, a position which he held until 1912, when he became superintendent of the American-Hawaiian Steamship Company, New York. After two years of service with this company, Mr. Shepard became associated with the Poole Engineering & Machine Company as general manager, as noted above, finally severing his connection with this company in order to devote his entire time to the general practice of marine engineering.

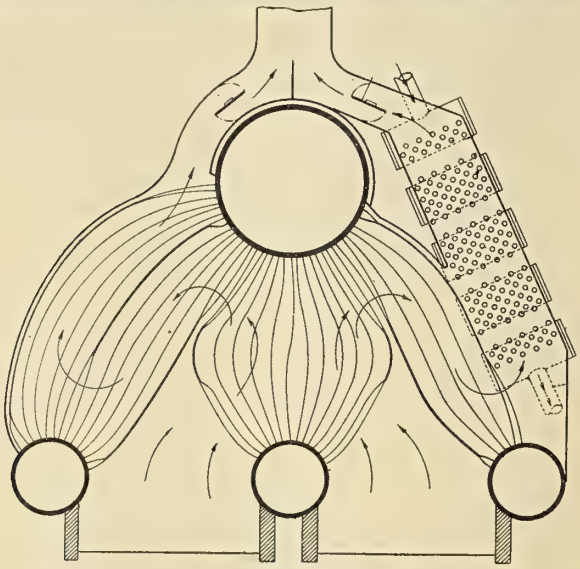
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents, compiled by Delbert H. Decker, Esq., registered patent attorney, Millerton, N. Y.

1,179,412. MARINE WATERTUBE BOILER AND SUPERHEATER. JULIUS EGGERS AND PETER THOMSEN, OF CASSEL-WILHELMSHOHE, GERMANY, ASSIGNORS TO SCHMIDT'SCHE HEISSDAMPF-GESELLSCHAFT, M. B. H., OF CASSEL-WILHELMSHOHE, GERMANY, A CORPORATION OF GERMANY.

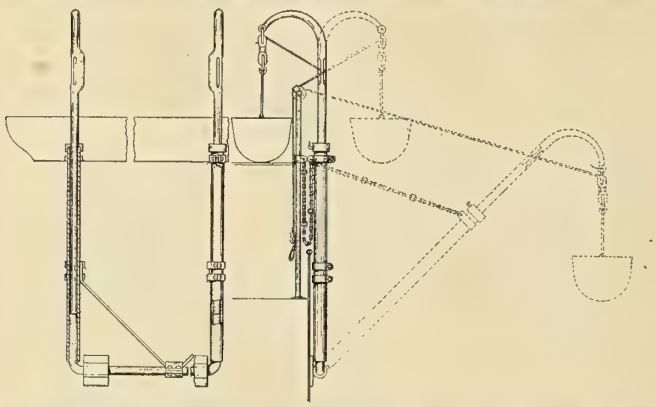
Claim 1.—In a marine boiler, a laterally disposed superheater comprising two groups of distributing and collecting heads respectively, at



least one of said groups being outside of the boiler casing, and groups of inclined tubes running lengthwise of the boiler between the header groups so as to form a set of series connected groups of tubes. Four claims.

1,180,322. SHIP'S DAVIT. EDGAR F. SANFORD, OF ALAMEDA, CAL.

Claim 1.—A davit comprising a rotatably mounted horizontal member having its ends upturned; a vertical tubular member fitted over each of said up-turned ends and affixed thereto; a vertical crane-member freely



fitted within each of said tubular members to leave a space therein for a lubricant and adapted to rotate on its axis within said tubular member; a cap at the upper end of each tubular member to retain the lubricant therein and to exclude water therefrom; and means for controlling the rotation of said horizontal member to cause the entire structure to swing outwardly and downwardly. Two claims.

1,179,440. STEERING APPARATUS FOR TORPEDOES. FRANK M. LEAVITT, OF SMITHTOWN, N. Y., ASSIGNOR TO E. W. BLISS COMPANY, OF BROOKLYN, N. Y., A CORPORATION OF WEST VIRGINIA.

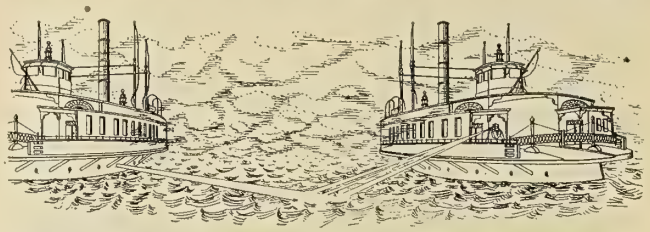
Claim 1.—In an automobile torpedo, the combination with steering means of primary and secondary controlling means, such primary means being adapted to operate upon the launching of the torpedo, and such secondary means being adapted to operate subsequently, and shifting means for transferring the control from the primary to the secondary means after the torpedo has reached its ultimate course. Three claims.

1,180,861. SUBMARINE BOAT. WILLIAM R. MACKLIND, OF CLEVELAND, OHIO.

Claim 8.—A submarine, comprising a plurality of hulls provided with bulkheads, a supporting structure interposed between and connected to said hulls and provided with longitudinally and transversely extending passages, said transversely extending passages communicating with said hulls. Thirty-three claims.

1,184,783. MEANS FOR OBSERVING AND SIGNALING BETWEEN SHIPS IN FOG. JAMES BUCKNER SPEED, OF WEST NEW BRIGHTON, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTERN ELECTRIC COMPANY, INCORPORATED, A CORPORATION OF NEW YORK.

Claim 1.—Means for signaling and observing between ships in fog, comprising means carried by each ship for projecting light outwardly from the ship near the surface of the water; means for intermittently cutting

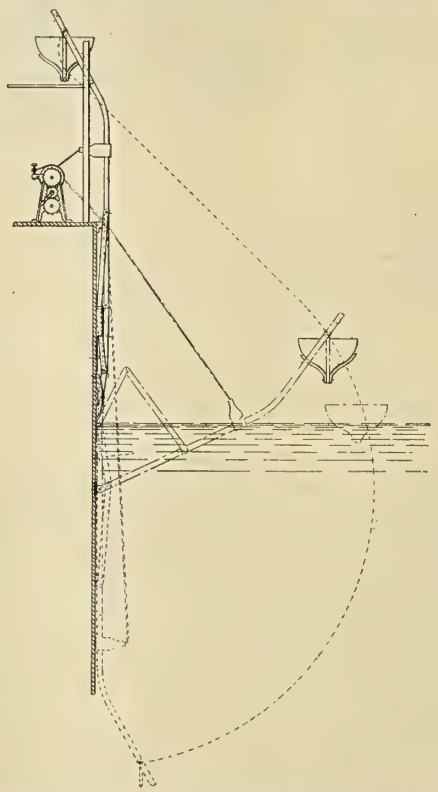


off projection of said light; and means, operating in synchronism with said last-mentioned means, for preventing an observer located on a ship near the surface of the water from observing the effect of light from other ships except during the intervals when the projection of light from his ship is cut off. Three claims.

British patents compiled by G. F. Redfern & Co., chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 10 Gray's Inn place, W. C., London.

9,115/15. APPARATUS FOR RAISING AND LOWERING SHIPS' BOATS. J. STORIE, OF 2, ROSSIE PLACE, IN THE CITY OF EDINBURGH, SCOTLAND.

The object is to provide an improved apparatus of simple construction which, among other advantages, will render it possible to launch boats from either side or both sides of a ship which by accident or otherwise has been caused to have a serious list; to launch boats safely in rough weather, or while the ship is rolling; and also while the ship is moving at a moderate speed. The invention relates to that kind of apparatus which comprises a cradle, or the like, adapted to support a boat by pivotal or other supports at each end, and arms adapted to support the said cradle, the said arms being substantially vertically disposed down the sides of the ship and pivotally mounted at their lower ends, and means whereby the arms may be turned in a vertical plane about their lower



ends. In arrangements of this class when it is required to launch a boat the arms are allowed to swing down, pivoting about their lower ends so that the cradle, which is supported between the upper ends, is swung wide of the side of the ship until the boat carried thereon reaches the water, when it automatically floats free of the cradle. In the improved apparatus the lower end of each arm is pivoted to a link, which itself is pivotally attached to the side of the vessel, whereby, when the apparatus is released or lowered, the boat will move in a downward direction even with a considerable degree of list on the ship. A pin or roller is provided near the upper end of each arm adapted to slide up or down in contact with a fixed substantially vertical member carried by the vessel, and the upper ends of the arms are bent inwardly so that the boats normally hang within the vessel's side. The link work is so designed that the boat automatically takes a downwardly inclined and practically straight path away from the vessel's side, and subsequently takes a path consisting of an arc of a circle.